Woodside Energy
Woodside Atmospheric Deposition Monitoring Program

Data Report – Annual Year 1

Woodside Atmospheric Deposition Monitoring Program

8 November 2023

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JBS&G Australia Pty Ltd T/A Strategen-JBS&G

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Abbreviations

Term	Definition
#N/A	Data not available
Insoluble fraction	Component of deposited dust that is not soluble in water. Deposited dust can comprise of aqueous soluble and insoluble materials depending on mechanisms and sources of dust emissions. The insoluble fraction is typically derived from crustal materials.
KBSF	King Bay Support Facility
NO_2	Nitrogen dioxide, Gaseous air pollutant from combustion sources
NH_3	Ammonia, Gaseous air pollutant from natural sources and industrial sources
NWS	North West Shelf
PQL	Practical quantification limit
RPD	Relative percent difference
Soluble fraction	Component of deposited dust that is soluble in water
SO_2	Sulfur dioxide. Gaseous air pollutant from oxidation (combustion) of sulphur-containing substances
WADMP	Woodside Atmospheric Deposition Monitoring Program

Executive Summary

The Woodside Atmospheric Deposition Monitoring Program (WADMP) commenced on 29 September 2021 with five monitoring stations (ACOEM 2021) – four lower Murujuga sites and one background site (Figure 2.1). Gaseous, rainwater and dust monitoring results are available for the first year of the program and are outlined in this report.

The stations were continually operated in 2022 to monitor for parameters that may potentially accelerate weathering of rock art, including acid depositions. This monitoring supplements an extensive dataset collected when the Pluto LNG plant was being constructed and commissioned between 2008-2013. While there are currently no set air quality thresholds for the protection of rock art, this monitoring data set will contribute to the ongoing knowledge regarding industrial emissions and cultural heritage.

Gaseous parameters with acid forming potential – ammonia (NH_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and nitric acid (HNO_3) were monitored. Initially Radiello, Gradko and Ferm passive samplers were deployed concurrently to evaluate the performance of each approach in the Murujuga environment.

The background site results were, as expected, lower than the concentrations determined for the gaseous monitoring conducted at the four lower Murujuga sites.

Gradko sampling, carried out for nine months (nominal 30-day exposure), was hindered by high blank (unexposed sampling media traveling with the batch) results exceeding the sample concentrations in many cases. Except for NO_2, the background site, which is located inland away from industrial emissions, was not resolvable from the other sites, suggesting this method of sampling is not fit for the purpose of the WADMP. It is unclear if this is due to low sensitivity of this sampling method or environmental factors influencing the sampling or degeneration of the sample media. The Gradko sampling was, therefore, discontinued from the program after nine sampling rounds due to the unreliability of the methodology under the monitoring program circumstances.

Ferm sampling (nominal 30-day exposure) determined concentrations of similar magnitude to those obtained by Radiello. Measured HNO_3 concentrations at the background site were unexpectedly higher than the Murujuga sites for some months and some NH_3 blank results were elevated (i.e., above the sample results).

Comparison of Radiello and Ferm sampling determined that the Radiello NO_2 dataset was typically more conservative than the Ferm dataset with a little more spread on the data. Relative trending between sites was similar for the two sampling methods with the KBSF Quarry dataset being highest followed by the Visitor Centre and AAQ Station, as expected due to their proximity to emissions sources.

The deposition flux was calculated from the gas concentrations determined by Radiello sampling.

Dust deposition sampling was carried out using dust deposition gauges to determine the amount of particulates falling out of the atmosphere. Deposited particulates were analysed for deposition of soluble and insoluble fractions and the soluble fraction analysed for anions and cations.

Analyses of rainwater samples collected during the program was included to determine the contribution to acid-forming species deposited on rock surfaces. Rainwater was collected and the composition was examined to determine wet deposition of anions and cations.

1. Introduction

JBS&G Australia Pty Ltd (JBS&G) is engaged by Woodside Energy (Woodside) to support the implementation and execution of the Woodside Atmospheric Deposition Monitoring Program (WADMP). The WADMP was established to proactively monitor for parameters, including acid depositions, that may potentially accelerate weathering of rock art on Murujuga (Burrup Peninsula).

The objectives of the WADMP are:

- Measure acid deposition at four locations on Murujuga and one reference site;
- Be designed as such to align with requirements of Condition 11 of Ministerial Statement (MS) 757 for Woodside's Pluto Liquified Natural Gas Development, which required the establishment of a nitrogen deposition monitoring program; and
- Compliment the work conducted by the State's Murujuga Rock Art Strategy and other industrial parties on Murujuga.

The WADMP commenced 29 September 2021 with five monitoring stations (ACOEM 2021) – four lower Murujuga sites, and one background site. The monitoring stations are provided and serviced by Acoem Ecotech under contract with JBS&G.

Details of the monitoring locations, program and results to 9 September 2022 (representing 12 rounds of sampling for a nominal 30 day duration) are presented herein.

2. Methodology

2.1 Monitoring locations

The monitoring site locations for the WADMP are summarised below (Table 2.1) and illustrated in Figure 2.1.

Table 2.1: Monitoring locations

Name	Nominal coordinates (GDA94_MGA_Zone50)		Description	Location ID
	Easting	Northing		
KBSF Quarry[1]	474,590	7,719,255	King Bay Support Facility (KBSF) Quarry (NWSJV Lease)	WEL-1
Mt Wongama	480,045	7,724,310	Mount Wongama Communication Site (NWSJV Lease)	WEL-2
Visitor Centre	476,775	7,722,033	North West Shelf (NWS) Project Visitors Centre Carpark	WEL-3
RT Pastoral Lease	450,093	7,689,580	Rio-Tinto Pastoral Lease (background monitoring site)	WEL-4
AAQ Station	476,660	7,721,042	Existing Ambient Air Quality (AAQ) Monitoring Station	WEL-5

(1) This a naming convention selected for the site adjacent to the quarry site; the quarry was not active during the monitoring period.Insert-table-footnote

Further information on the siting of monitoring locations used for the WADMP, including assessment against the requirements of AS/NZS 3580.1.1:2016 *Methods for Sampling and Analysis of Ambient Air - Guide to Siting Air Monitoring Equipment,* is summarised in the Location Reconnaissance Trip Report (Strategen-JBS&G 2021a).

2.2 Monitoring program

The WADMP includes:

- Gases contributing to acid deposition;
- Anion and cations in rainwater;
- Anion and cation deposition in deposited dust; and
- Prevailing meteorology at each site (wind speed and direction).

Sampling duration is nominally 30 days except for Radiello sampling, which was conducted nominally every 15 days. Due to the variable length of the calendar month, the sampling does not fit into a monthly regime. Therefore, the sampling is referred to by the sampling round or the sampling commencement date. A quarter is used throughout the report to refer to a duration equalling three nominal 30-day sampling rounds or six nominal 15-day sampling rounds. This annual report covers the first four quarters of the WADMP i.e., twelve 30-day sampling rounds or twenty-four 15-day sampling rounds.

The monitoring conducted at each location is summarised in Table 2.2.

Samples are referenced to the beginning of the sampling period throughout this report.

Table 2.2: Instrumentation and infrastructure

Parameter	KBSF Quarry	Mt Wongama	Visitor Centre	RT Pastoral Lease	AAQ Station
Passive air sampling for: • Nitrogen dioxide (NO_2); • Sulfur dioxide (SO_2); • Ammonia (NH_3); • Nitric acid (HNO_3).	✓	✓	✓	✓	✓
Rainwater analysed for: • pH; • Cations (Na^+, K^+, Mg^{2+}, Ca^{2+}); • Anions (Cl-, SO42-, Alkalinity [CO_3^{2-}, HCO_3^-, OH^-, total alkalinity]); • Nitrogen species (TKN, NH_3, NO_2 NO_3-, total N, organic N, NOx); • Phosphate (ortho PO_4^{3-}); • Volatile carboxylic acid suite (incl. formic acid $HCOO^-$, acetic acid CH_3COO, propionic acid $C_2H_5COO^-$).	✓	✓	✓	✓	✓
Deposited dust analysed for: • Cations (Na^+, K^+, Mg^{2+}, Ca^{2+}); • Anions (Cl-, SO42-, Alkalinity [CO_3^{2-}, HCO_3^-, OH^-, total alkalinity]); • Nitrogen species (TKN, NH_3, NO_2 NO_3-, total N, organic N, NOx); • Phosphate (ortho PO_4^{3-}).	✓	✓	✓	✓	✓
Wind speed & direction	✓	✓	✓	✓	✓
Temperature				✓	✓
Humidity				✓	✓

Legend

- Monitoring Locations

Scale: 1:50,000 at A4

0 250 500
Meters

Coord. Sys. GDA2020 MGA Zone 50

Job Number: 60257

Client: Woodside Energy

Version: A | Date: 28-Apr-2023

Drawn By: droberts | Checked By: JB

Murujuga
Burrup Peninsula, WA

WOODSIDE ATMOSPHERIC DEPOSITION MONITORING PROGRAM - MONITORING LOCATIONS

FIGURE 2.1

JBS&G

File Name: W:\Projects\1)Open\Woodside\60257 Acid Deposition Monitoring Program\GIS\Maps\Acid_Deposition_Monitoring_Program_60257\Acid_Deposition_Monitoring_Program_60257.aprx
Image Reference: World Imagery: Earthstar Geographics

3. Results and discussion

3.1 Gaseous monitoring

3.1.1 NH_3, NO_2, SO_2 and HNO_3 Radiello monitoring results

Monitoring of gases NH_3, NO_2, SO_2 and HNO_3 using Radiello passive sampling was conducted, on a nominal 15-day exposure cycle commencing 29 September 2021.

Due to rain causing the access track to be impassable, recovery of the RT Pastoral Lease samples deployed on 25 January 2022 due for collection on 9 February 2022 were not collected until 23 February 2022. Similarly, for the samples deployed on 4 May 2022 due for collection on 19 May 2022, access was not possible; therefore, the samples were collected 15 June 2022 once the access track was passable. The Radiello samplers were consequently deployed for four weeks and eight weeks during these periods, respectively (rather than the recommended nominal 15 days). While data was obtained that is indicative of the concentration over the extended period and, therefore, was not excluded from the dataset, the reported concentrations are outside the specifications of the program.

Duplicate sampling was conducted at all sites for all rounds excluding those commencing 29 December 2021 and 12 January 2022. The highest result from duplicate pairs were used to compile the dataset for data analysis.

A summary of the results obtained for the first 24 rounds of the WADMP is presented below (Table 3.1 to Table 3.4).

Table 3.1: Summary of NO_2 concentration monitored by Radiello sampling

Species	NO_2 µg/m³				
Site	KBSF Quarry	Mt Wongama	Visitor Centre	RT Pastoral Lease	AAQ Station
Minimum	2.73	0.93	2.06	0.94	1.72
Average	5.77	2.87	4.10	1.56	3.84
Maximum	13.82	7.24	8.38	3.27	7.38

Table 3.2: Summary of HNO_3 concentration monitored by Radiello sampling

Species	HNO_3 µg/m³				
Site	KBSF Quarry	Mt Wongama	Visitor Centre	RT Pastoral Lease	AAQ Station
Minimum	0.04	0.04	0.04	0.04	0.04
Average	0.66	1.02	0.99	0.39	0.86
Maximum	2.31	5.98	5.79	1.84	4.03

Table 3.3: Summary of SO_2 concentration monitored by Radiello sampling

Species	SO_2 µg/m³				
Site	KBSF Quarry	Mt Wongama	Visitor Centre	RT Pastoral Lease	AAQ Station
Minimum	0.01	0.01	0.01	0.01	0.01
Average	0.16	0.26	0.41	0.08	0.24
Maximum	0.48	1.48	2.72	0.34	1.12

Table 3.4: Summary of 1 year of 15 day NH_3 concentrations monitored by Radiello sampling

Species	NH_3 µg/m³				
Site	KBSF Quarry	Mt Wongama	Visitor Centre	RT Pastoral Lease	AAQ Station
Minimum	0.22	0.06	0.07	0.07	0.20
Average	1.30	0.37	0.46	0.34	0.54
Maximum	4.07	1.45	1.23	0.29	1.78

NO_2 concentrations (Figure 3.1) at the sites located on Murujuga in closest proximity to industry emissions sources had similar trending throughout the year implying they were representative of the broader airshed.

NO_2 concentrations were determined to be typically lowest at RT Pastoral Lease and at Mt Wongama, which is at an elevated position and furthest away from industry than the other Murujuga monitoring sites.

The exceptions to this, occurring during Quarter 1 and Quarter 3, were the sampling commencing 29 November 2021 and 5 April 2022 when Mt Wongama experienced the highest concentrations. During these fortnightly monitoring periods, the site was influenced by winds more frequently from the southwest in the direction of nearby industrial activities than in the neighbouring monitoring periods (Figure 3.2). During April 2022, the higher concentration at Mt Wongama coincided with a peak in concentration at the other Murujuga sites.

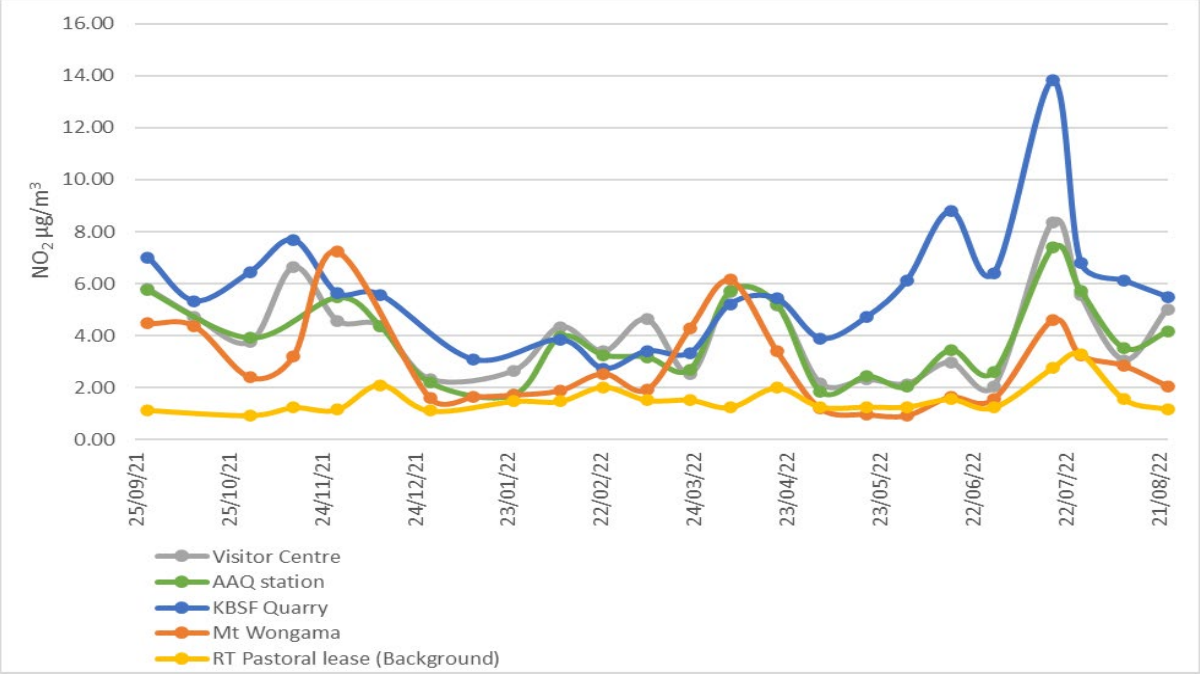

Figure 3.1: Measured 15 day average NO_2 by Radiello sampling

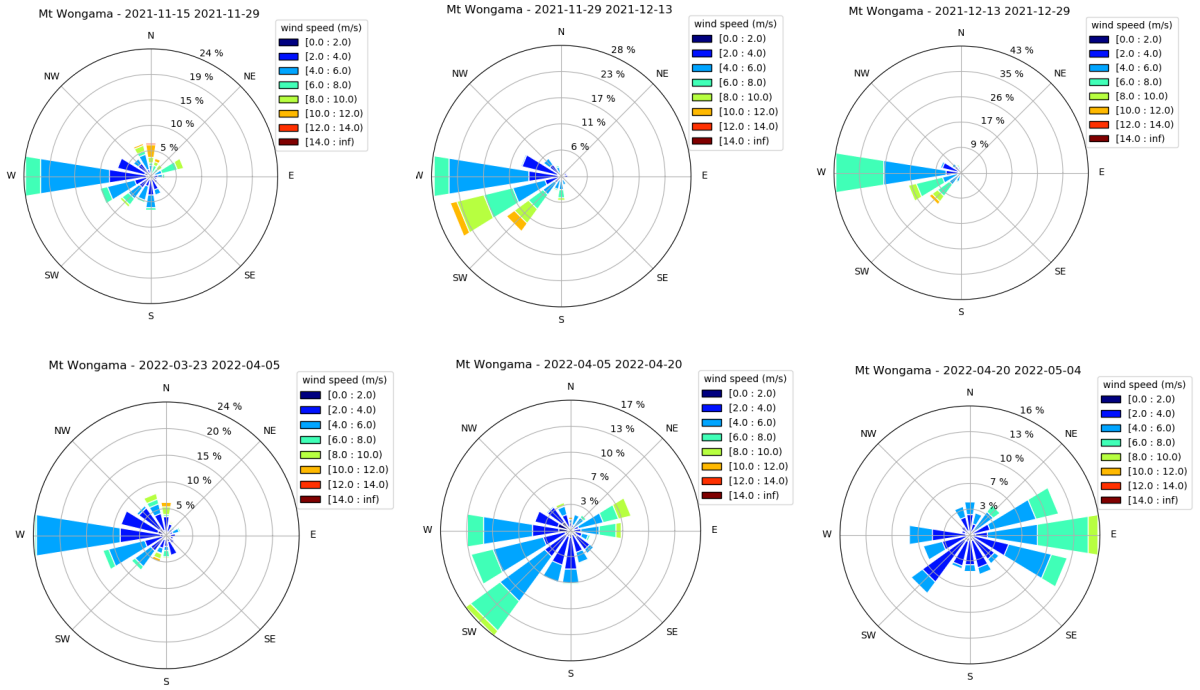

Figure 3.2: Mt Wongama wind roses

Concentrations of HNO_3 showed some concurrent peaks with SO_2 at the Visitors Centre, AAQ Station and Mt Wongama during Quarter 2 and Quarter 3 suggesting a common emission source, and Mt Wongama during Quarter 2 and Quarter 3 suggesting a common emission source. Little relative trending of sites was observable (Figure 3.3 and Figure 3.4).

Concentrations of NH_3 experienced some peaks in concentrations in the second and third quarters (Figure 3.5). At KBSF Quarry, the peak concentrations detected in January and May 2022 were more than twice the extent observed at other Murujuga sites. No correlation with wind direction could be determined.

At the other Murujuga sites, concentrations between January and March 2022 were similar magnitude to those detected at KBSF Quarry and were higher than during the first quarter. At all sites, excluding KBSF Quarry, concentrations detected from the end of June 2022 through to the end of August 2022 returned to the low levels determined from October to December in the previous year. While KBSF Quarry concentrations exhibited a downward trend during this period, they remained above the other Murujuga sites.

No peaks in NH_3 concentration were detected at the RT Pastoral Lease site, which is distant from industrial sources on the peninsula.

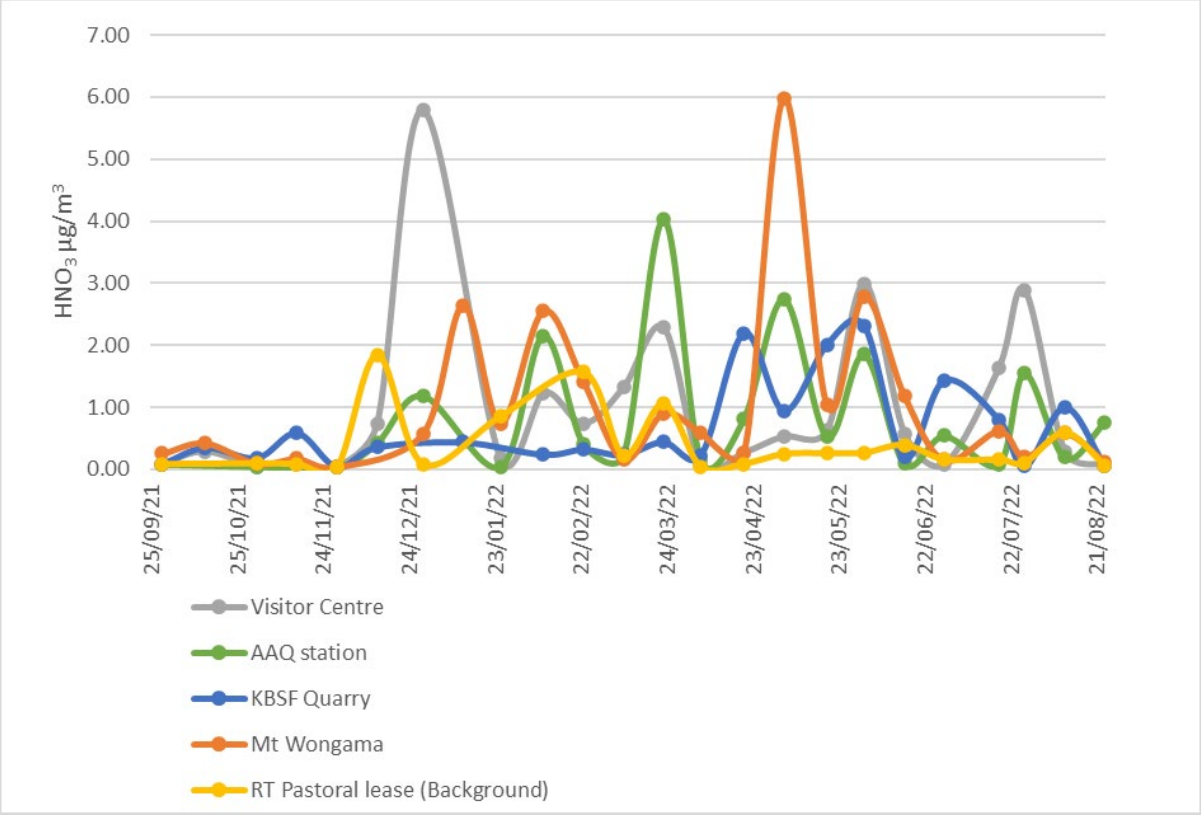

Figure 3.3: Measured 15 day average HNO_3 by Radiello sampling

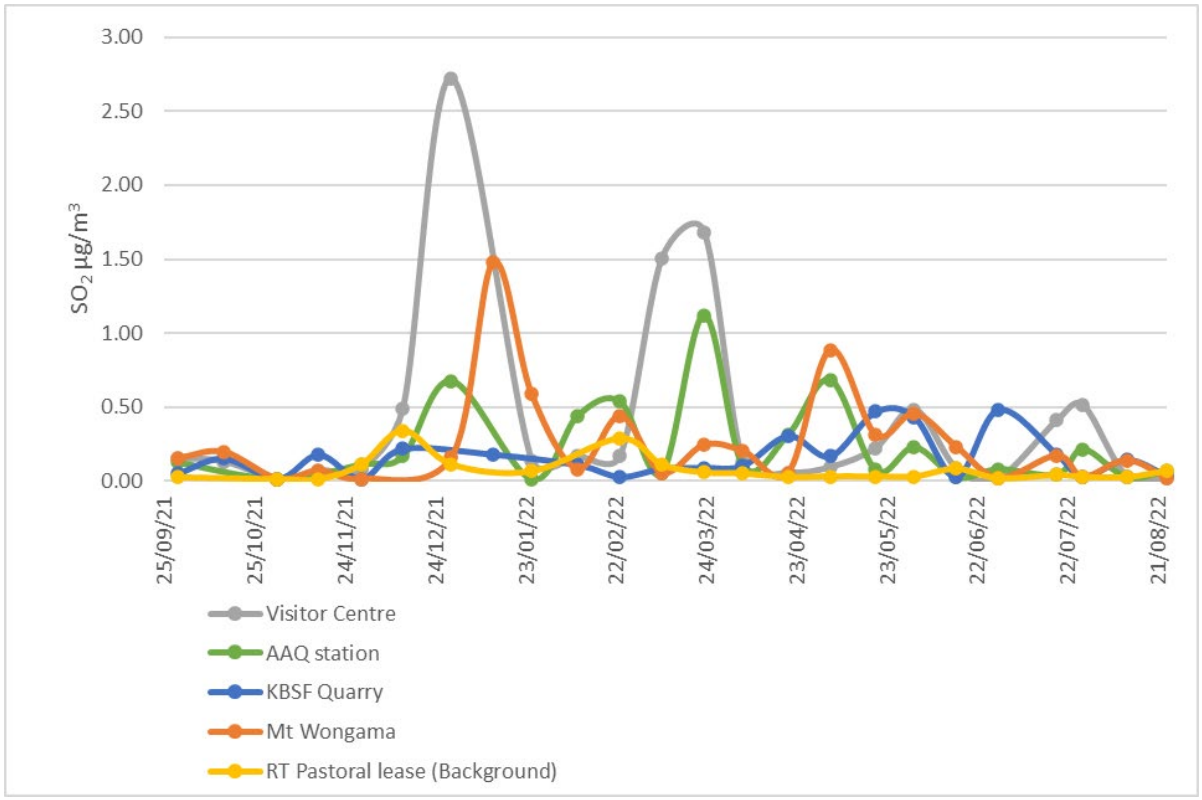

Figure 3.4: Measured 15 day average SO_2 by Radiello sampling

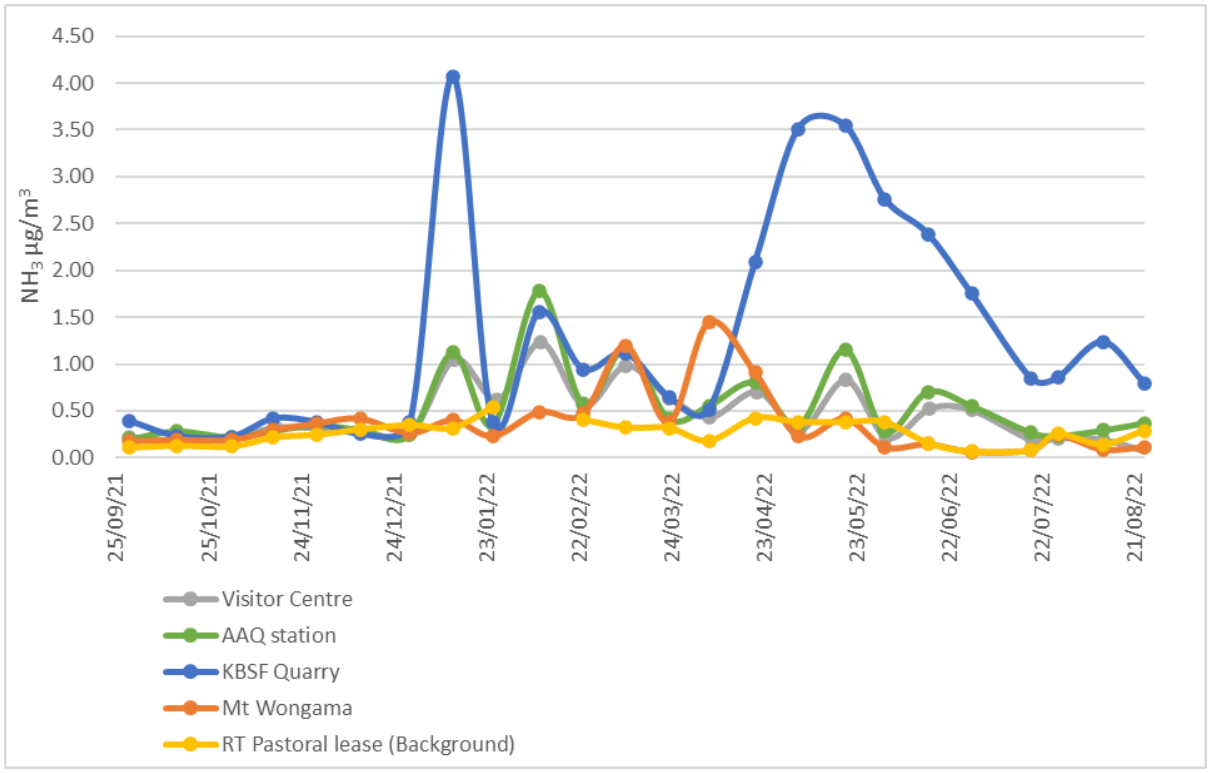

Figure 3.5: Measured 15 day average NH_3 by Radiello sampling

3.1.2 NH_3, NO_2, SO_2 and HNO_3 Gradko monitoring results

Results from nine of the twelve rounds of Gradko sampling (nominal 30-day exposure) of gaseous species were available. The exceptions were the initial sampling round at the RT Pastoral Lease site and sample from monitoring commencing 20 April 2022, due for collection on 19 May 2022, at the same location. The exposure was prolonged due to restricted access because of significant rains and was outside the recommended duration, but the data has been included (2-month average concentration presented for both months) for completion. The April 2022 sampling round (Round 7) was a shortened duration (15 days) due to international transit delays delaying the start (planned start 23 March 2022; actual start 5 April 2022).

Duplicates sampling was conducted for the first three sampling rounds at all sites and only at AAQ Station thereafter. The highest result from duplicate pairs were used to compile the dataset for analysis. Data from the compiled data set[1] is presented in Figure 3.6, Figure 3.7, Figure 3.8 and Figure 3.9 below.

Reporting limits were provided by Gradko as µg/tube. NH_3 samples, including blanks, were in excess of 6x the reported laboratory detection limit; SO_2 samples were typically close to (within 2x) the detection limit (0.09 µg/tube); a detection limit for HNO_3 was provided as 2.04 µg/m^3 (<0.09 µg/tube) with all but one sample (from the last round of sampling at the background site, which had an extended duration due to being inaccessible after rains) exceeding the limit; NO_2 samples were all in excess of 0.004 µg/m^3 (reported for the lowest blank).

The Gradko results, except for NO_2, were impacted by high field blanks. These results are, therefore, presented as indicative only to evaluate the trending. Travel blanks were found to have similarly high results as the field blanks, suggesting the high background was not attributable to the handling of the samples in the field (travel blanks are stored in the fridge and returned with the field blanks and exposed sampling media). Samples were also reported as outside the expiry date for the tubes. This was due to the logistics and time taken for obtaining and returning samplers to international laboratories (USA and UK). The exception was the NO_2 samples, which were not recorded as being outside the expiry period.

The concentrations recorded were close to the laboratory reporting limit (typically within 10x) for all species.

The NO_2 data from the Gradko sampling shows similar trending and magnitude of concentrations as reported from the Radiello samples. The exception was the KBSF Quarry data for Round 8, which was around 3x the peak concentration previously detected. It is unclear what caused this; the Ferm and Radiello data show a peak for this round, but these were not greatly in excess of the previous maximum, which suggests the Gradko data may be an artefact. The HNO_3, SO_2, and NH_3 concentrations were typically an order of magnitude higher than reported from the concurrent Radiello sampling, and peaks evident in the monthly concentrations determined from the Radiello sampling were not resolved.

The RT Pastoral Lease site is remote with no nearby emission sources and, therefore, is expected to yield lower results for monitored gaseous species than the lower Murujuga sites closer to industrial emissions. However, the concentrations recorded at the RT Pastoral Lease were typically lower than the Murujuga samples for NO_2 but not for any of the other species.

The continued lack of resolution between the background and Murujuga sites, which are expected to be exposed to industry emissions, indicates that the Gradko samplers may not be sensitive enough to monitor the airshed concentrations of the required analytes. It is also possible that the

[1] Highest sample selected from duplicates as conservative position, except for Round 2 where the SO_2 concentration at the KBSF Quarry exhibited a high duplicate (46.8 µg/m^3), which appears to be an outlier when compared to the primary sample (13.7 µg/m^3) and concentrations recorded for other sites. Therefore, the primary sample was used in the dataset.

harsh environmental conditions influenced the Gradko sampling. The fact that the field and travel blanks yielded higher results than the samples contribute further to uncertainty in the validity of the results. Consequently, the Gradko sampling was discontinued after Round 9 and are not subject to further data analysis.

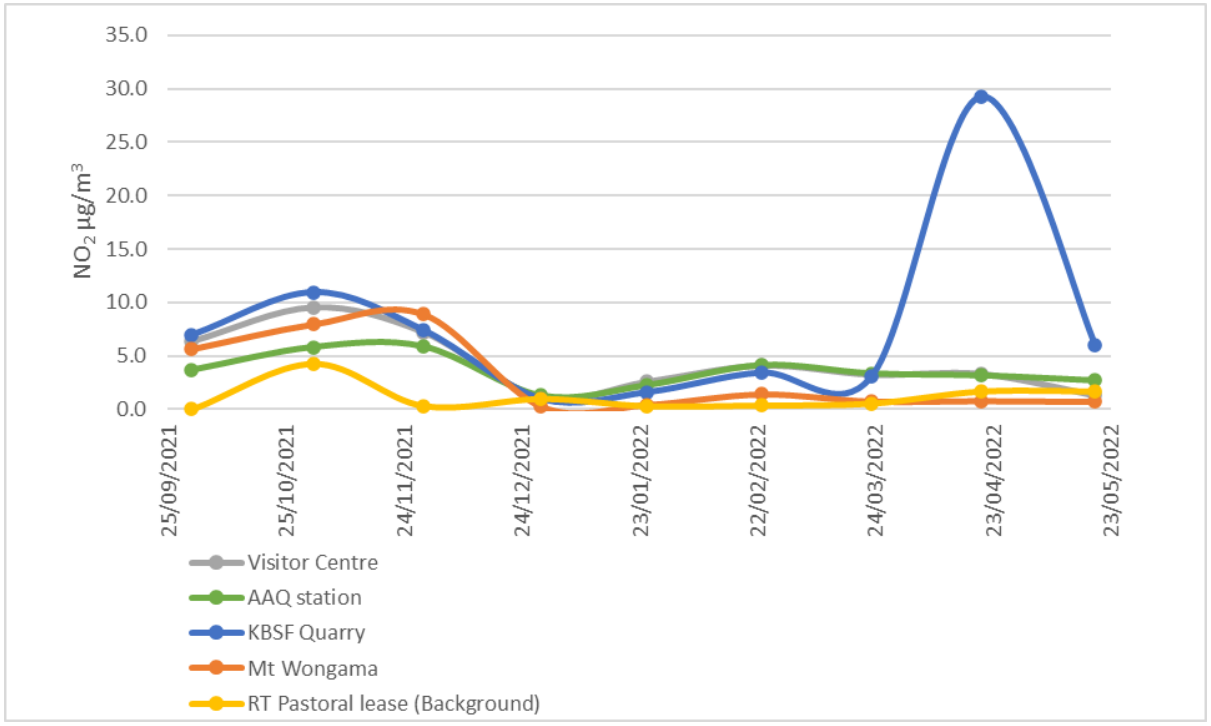

Figure 3.6: Measured 30 day average NO_2 by Gradko sampling

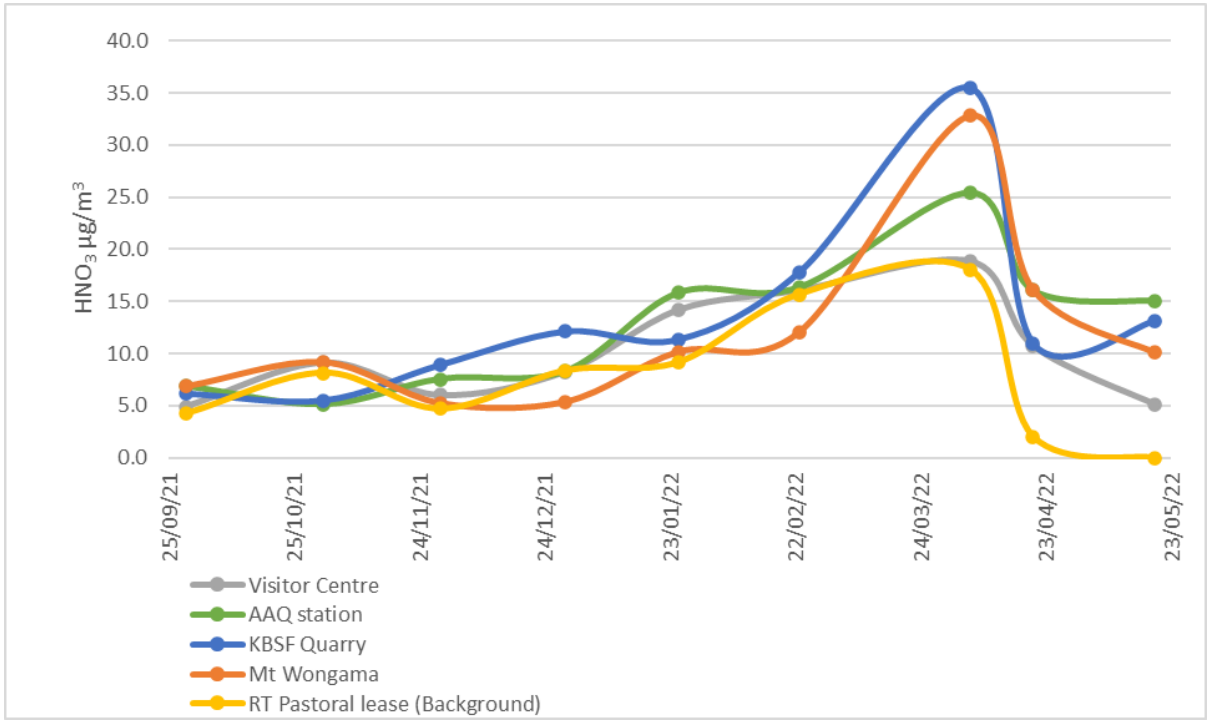

Figure 3.7: Measured 30 day average HNO_3 by Gradko sampling

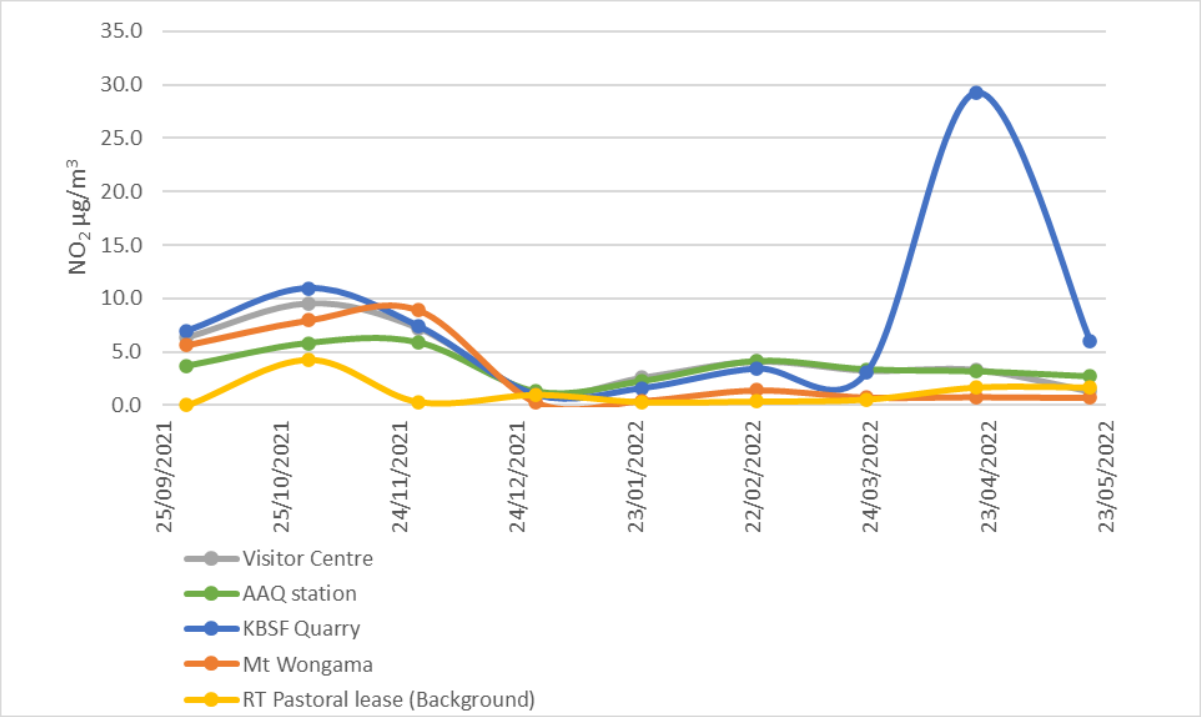

Figure 3.8: Measured 30 day average SO_2 by Gradko sampling

Figure 3.9: Measured 30 day average NH_3 by Gradko sampling

3.1.3 NH_3, NO_2, SO_2 and HNO_3 Ferm monitoring results

Ferm passive sampling for NH_3, NO_2, SO_2 and HNO_3 was conducted on a nominal 30-day exposure cycle commencing 29 September 2021. At the RT Pastoral Lease site, the sample exposure commencing 20 April 2022, due for collection on 19 May 2022, was prolonged due to restricted access because of significant rains. The sample was collected on 15 June 2022, outside the recommended duration; the data has been included (2-month average concentration presented for both months) for completion.

A summary of all the compiled datasets obtained for the first twelve rounds is presented below (Table 3.5, Table 3.6, Table 3.7, Table 3.8).

Table 3.5: Summary of 30 day average NO_2 concentration monitored by Ferm sampling

Species	NO_2 µg/m³				
Site	KBSF Quarry	Mt Wongama	Visitor Centre	RT Pastoral Lease	AAQ Station
Minimum	2.66	1.15	1.50	0.85	1.91
Average	4.40	2.44	3.29	1.21	3.26
Maximum	6.63	5.17	4.23	1.53	4.61

Table 3.6: Summary of 30 day average HNO_3 concentration monitored by Ferm sampling

Species	HNO_3 µg/m³				
Site	KBSF Quarry	Mt Wongama	Visitor Centre	RT Pastoral Lease	AAQ Station
Minimum	0.02	0.12	0.00	0.20	0.13
Average	0.27	0.35	0.34	0.38	0.42
Maximum	0.58	0.60	0.62	0.53	0.67

Table 3.7: Summary of 30 day average SO_2 concentration monitored by Ferm sampling

Species	SO_2 µg/m³				
Site	KBSF Quarry	Mt Wongama	Visitor Centre	RT Pastoral Lease	AAQ Station
Minimum	-0.03	0.05	0.05	-0.04	0.01
Average	0.16	0.16	0.20	0.07	0.22
Maximum	0.39	0.31	0.44	0.20	0.46

Table 3.8: Summary of 30 day average NH_3 concentration monitored by Ferm sampling

Species	NH_3 µg/m³				
Site	KBSF Quarry	Mt Wongama	Visitor Centre	RT Pastoral Lease	AAQ Station
Minimum	0.00	-0.24	-0.27	-0.58	0.03
Average	1.07	0.34	0.36	0.23	0.48
Maximum	4.06	1.17	1.38	0.63	1.19

Data were plotted to examine the relative concentrations at the sites (Figure 3.10, Figure 3.11, Figure 3.12 and Figure 3.13). Field blank data is included for illustration since some blanks were elevated with respect to sample concentrations.

NO_2 concentrations (Figure 3.10) were determined to be the lowest at the RT Pastoral Lease site. Mt Wongama, which is at an elevated position furthest away from industry, also typically recorded NO_2 concentrations below the other lower Murujuga monitoring sites. The highest NO_2 concentrations were largely detected at KBSF Quarry. The results are comparable in magnitude, trend and relative concentrations between sites to those seen from the Radiello sampling (Section 3.1.4).

HNO_3 was reported as highest at the RT Pastoral Lease site for the first four sampling rounds; however, concentrations for the remainder of the year were within the range of the other sites. Concentrations reported for Mt Wongama were typically in the middle of the range of concentrations reported across the sites for any sampling round. It was expected that HNO_3 would be highest at the sites most likely to experience the impacts of industrial emissions. An explanation for why the data does not reflect that is not currently evident.

SO_2 and NH_3 concentrations were typically low and very close to the limit of reporting (within 10x). Some issues with the blanks exceeding the sample concentrations (including in some cases samples determined as non-detect while blanks contained detectable quantities of analyte) occurred and these are evident from the negative data.

NH_3 concentrations were of similar magnitude to those reported from the Radiello sampling with trending comparable at all sites.

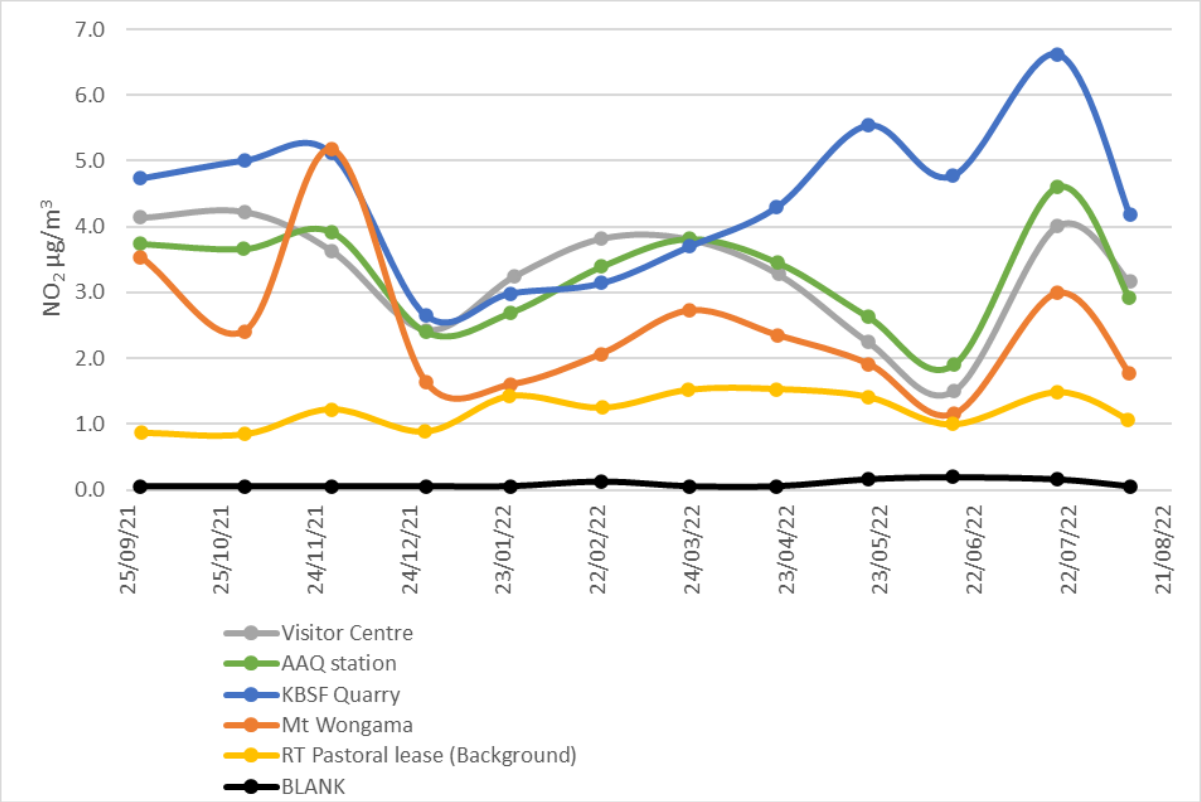

Figure 3.10: Measured 30 day average NO_2 by Ferm sampling

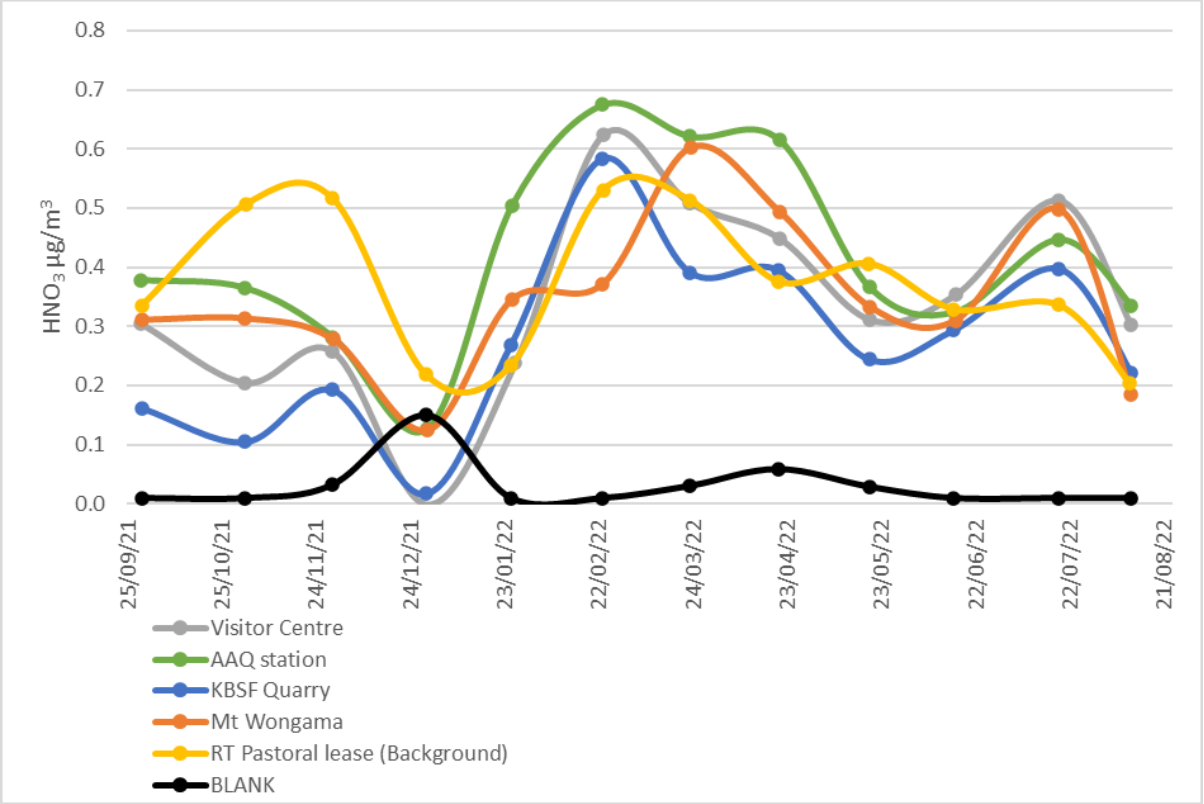

Figure 3.11: Measured 30 day average HNO_3 by Ferm sampling

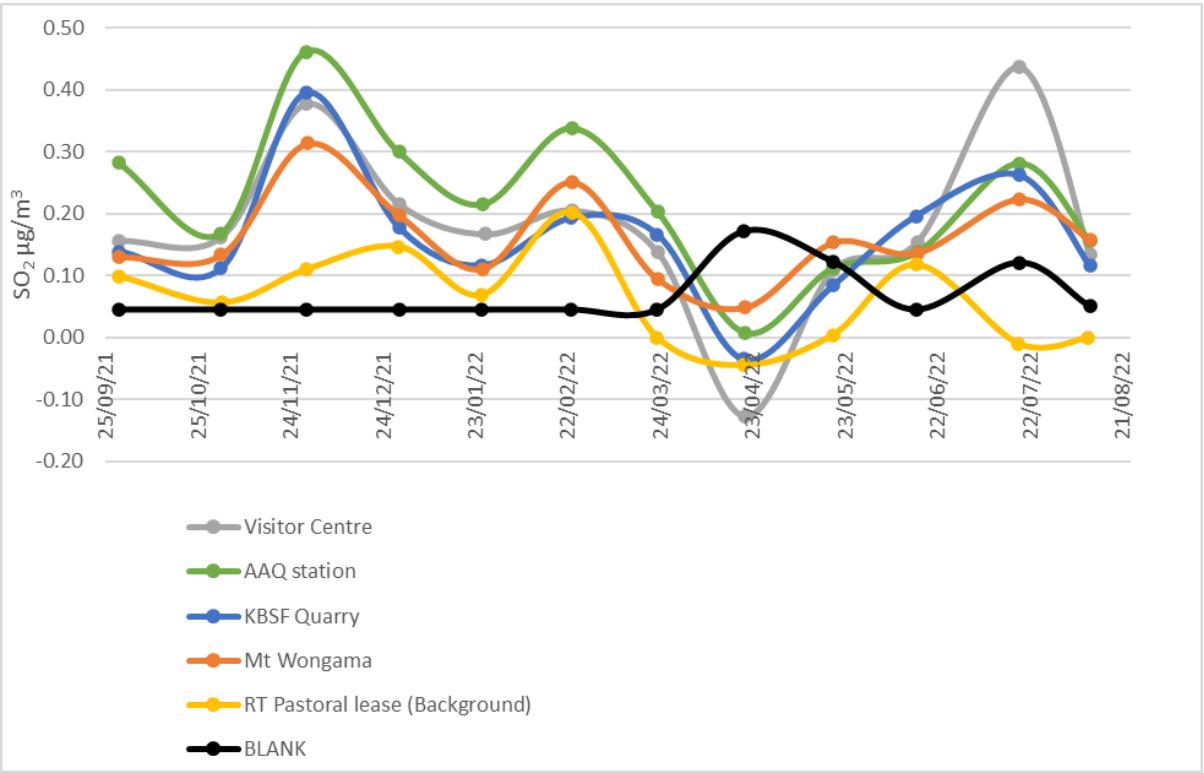

Figure 3.12: Measured 30 day average SO_2 by Ferm sampling

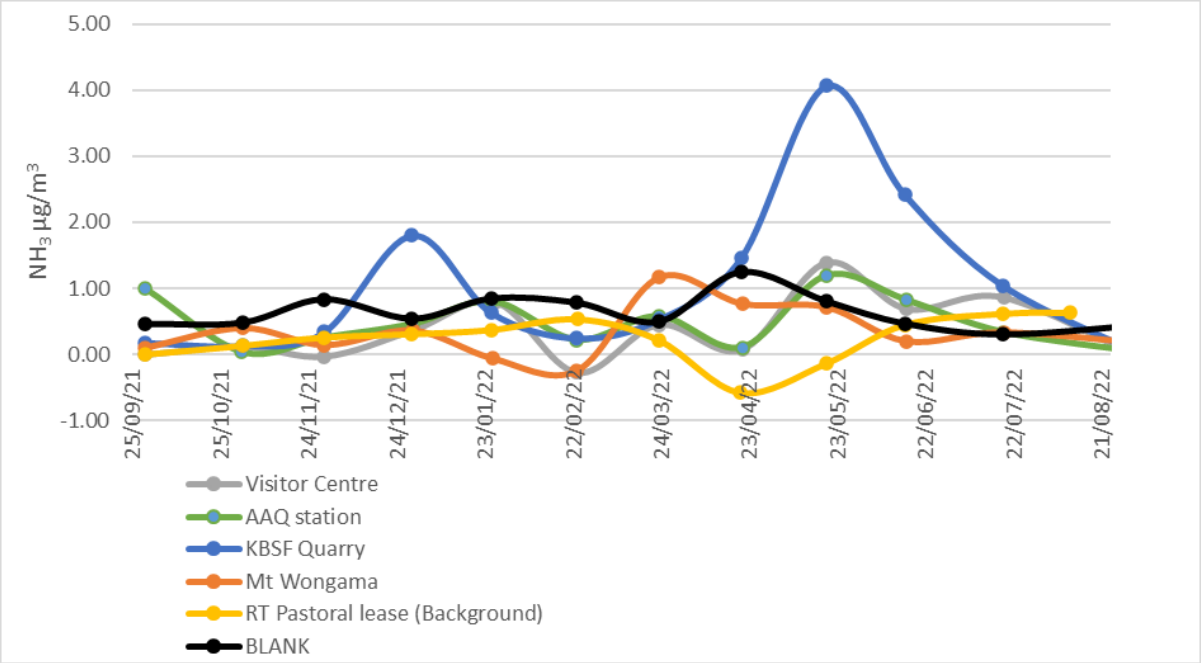

Figure 3.13: Measured 30 day average NH_3 by Ferm sampling

3.1.4 Comparison of sampler performance

To facilitate comparison of the sampler performance, the data (30 day average) distributions were compared (Figure 3.14, Figure 3.16, Figure 3.17, and Figure 3.18).

The Radiello NO_2 dataset was typically more conservative than the Ferm dataset, with a little more spread on the data. Analysis determined no statistical difference between the datasets. Relative trending between sites was similar for the two sampling methods, with the KBSF Quarry dataset being highest then Visitor Centre and AAQ Station.

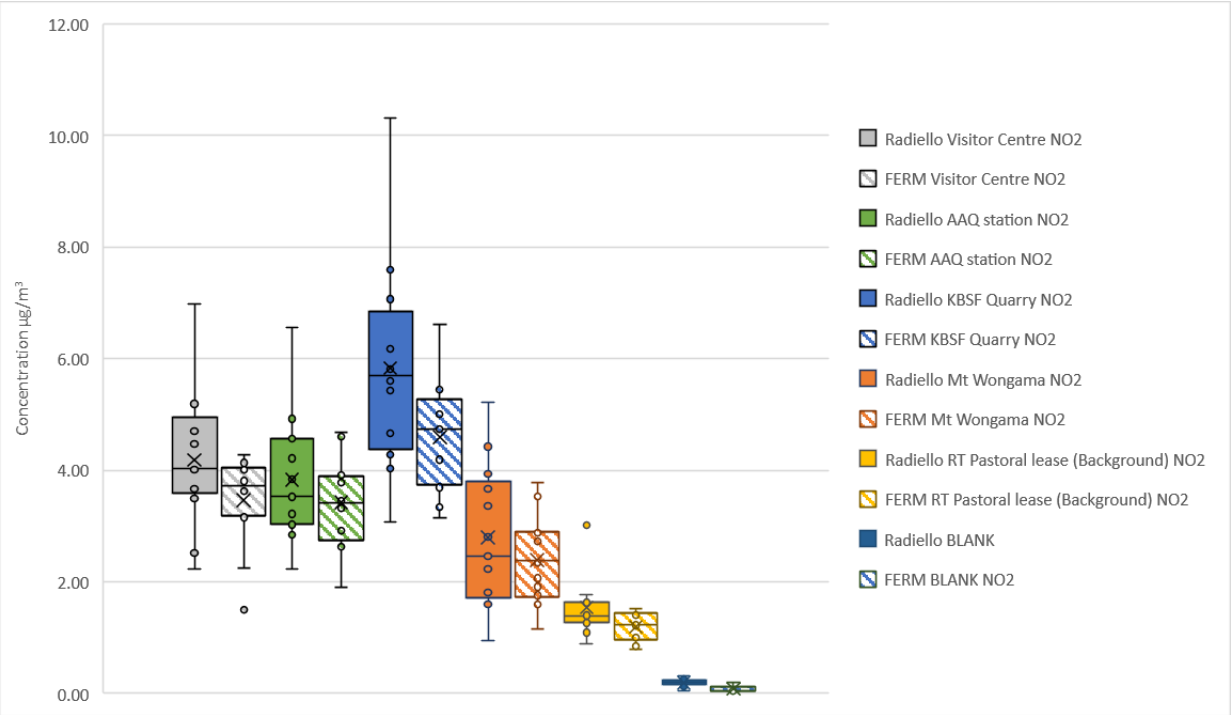

Figure 3.14: Comparison of NO_2 Radiello and Ferm 30 day average datasets

A comparison on the NO_2 results for Radiello and Gradko was also conducted for the nine month period data was available for both sampling methods (Figure 3.15). The very high result (29.2 µg/m^3 recorded 20 April 2022 to 19 May 2022) at KBSF Quarry was removed from the chart to aid visualisation of the data. While the Gradko dataset shows a lot more spread on the data the relative trending between sites was similar for the two sampling methods and no significant statistical difference was determined.

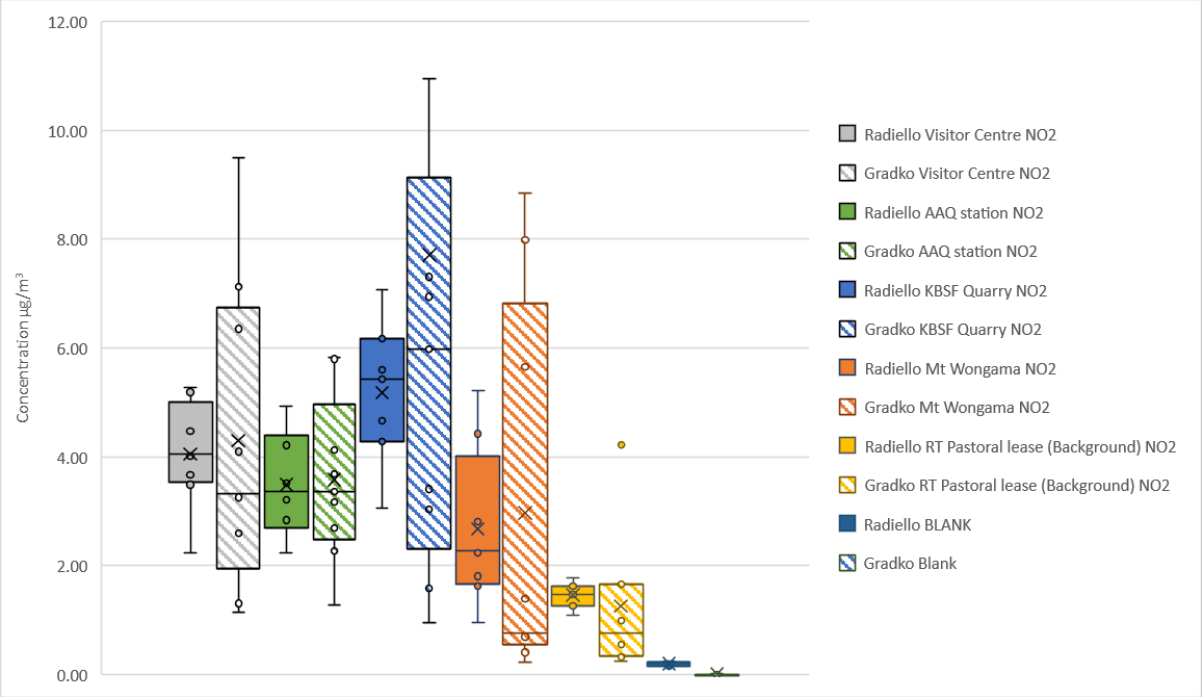

Figure 3.15: Comparison of NO_2 Radiello and Gradko 30 day average datasets

The Radiello SO_2 data set showed a greater spread than the Ferm data, in particular at higher concentrations. Notably, the Mt Wongama Ferm dataset is lower and more clustered compared to Radiello. This site is on top of an exposed hill subject to higher wind speeds than other sites (Section 3.2.1); therefore, it is possible the wind is influencing passive sampling at this site. The Visitor Centre Ferm SO_2 dataset is clustered in a narrower range than the Radiello samples, with the highest and lowest concentrations treated in the box and whisker plot as outliers.

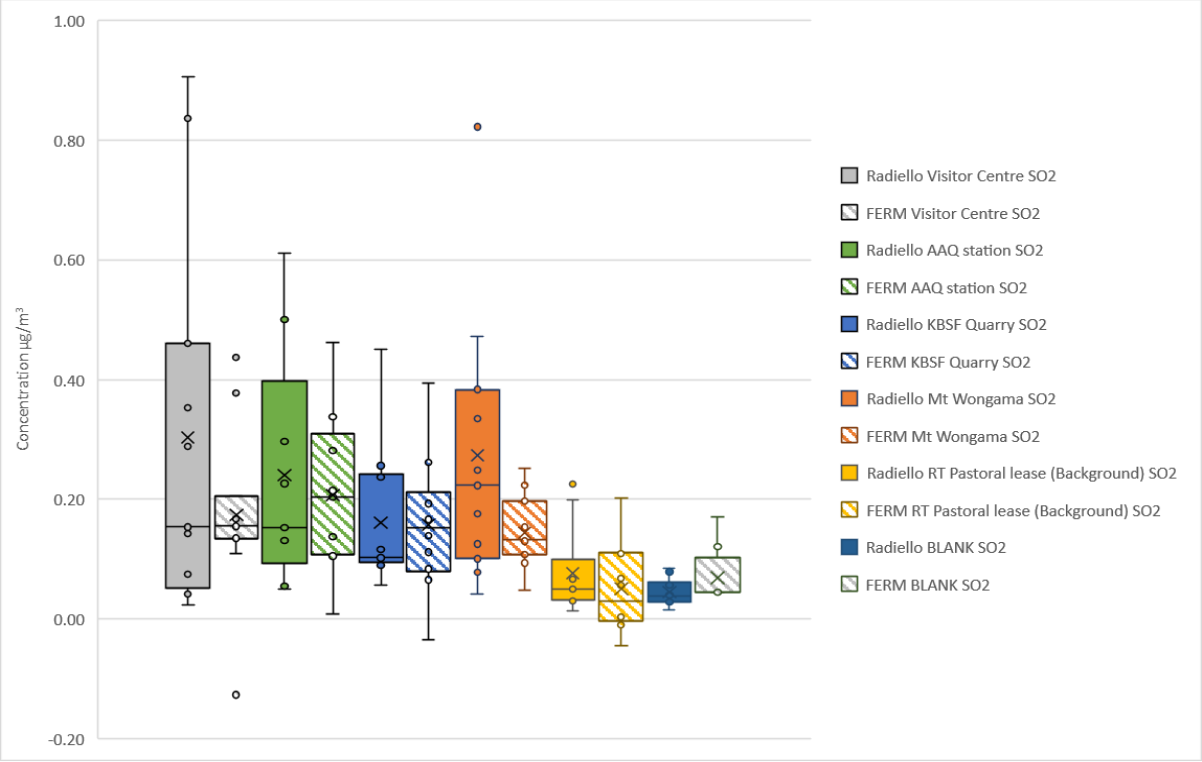

Figure 3.16: Comparison of SO_2 Radiello and Ferm 30 day average datasets

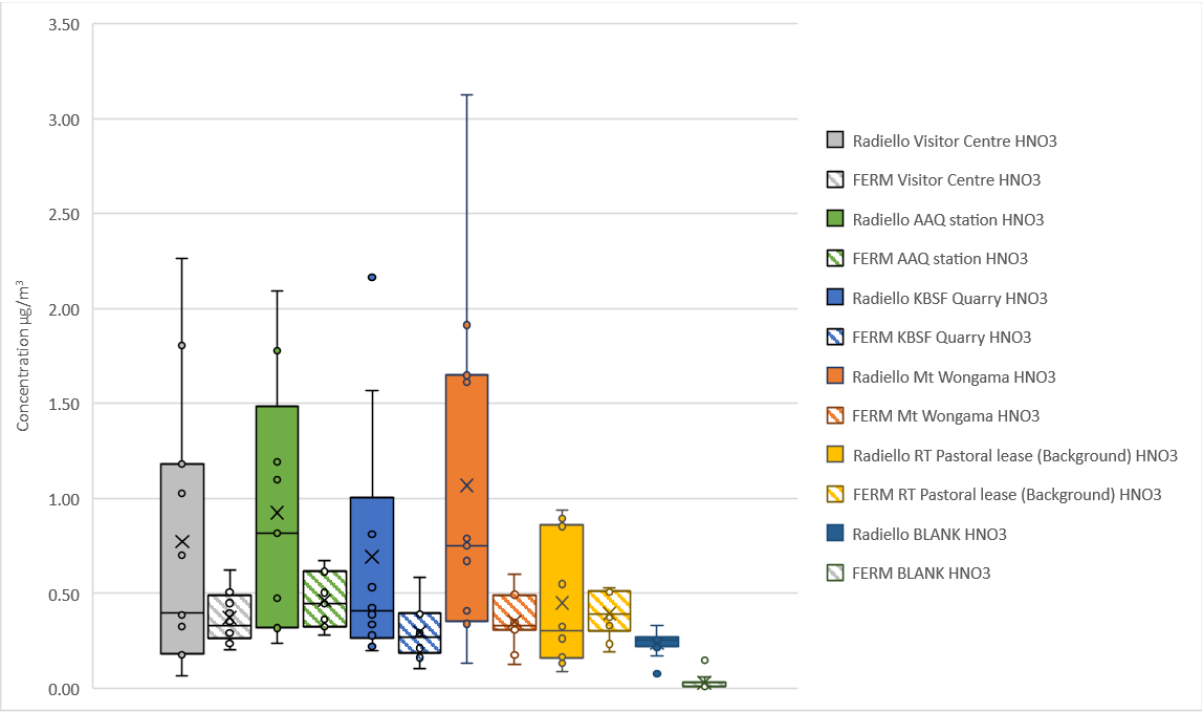

Figure 3.17: Comparison of HNO_3 Radiello and Ferm 30 day average datasets

Concentrations of HNO_3 reported from Radiello sampling are higher than from Ferm sampling. Some sample concentrations were below zero following blank subtractions.

Generally, the extent of the variation in concentrations detected from Radiello sampling for NO_2, HNO_3 and SO_2 is greater than captured by Ferm sampling. It is not possible from the data in hand to determine which is most likely to reflect the actual concentrations.

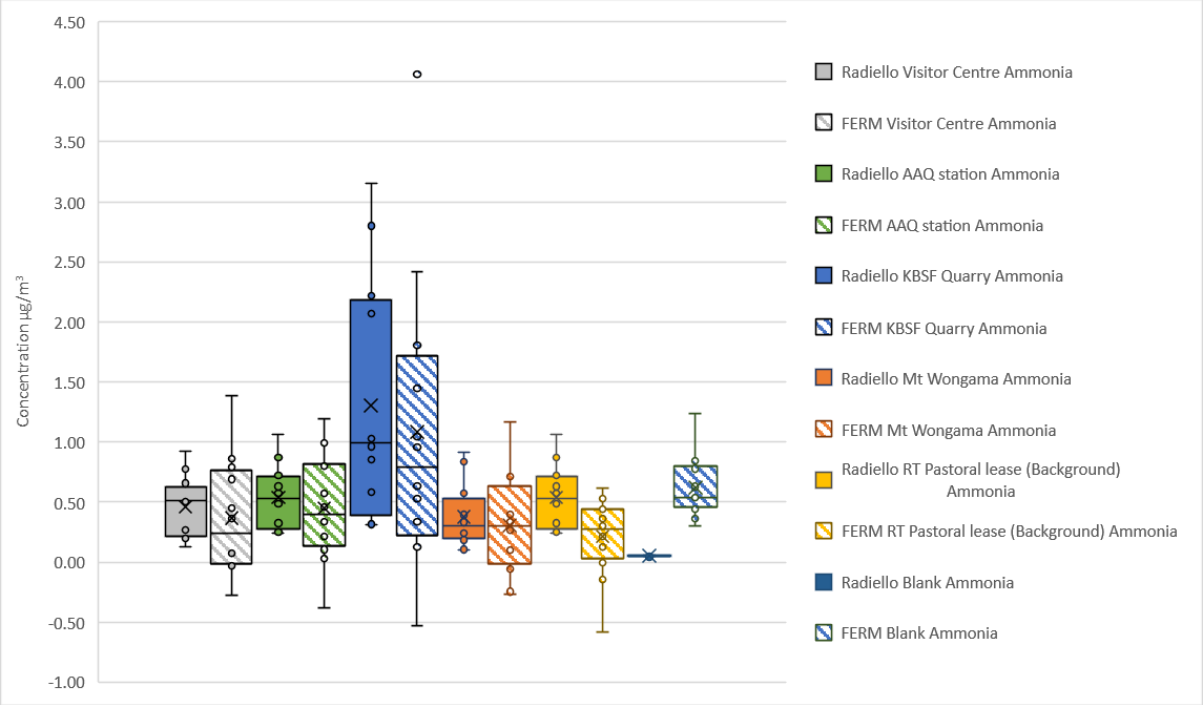

Figure 3.18: Comparison of NH_3 Radiello and Ferm 30 day average datasets

NH_3 sampling determined Ferm background concentrations to be similar to concentrations detected in Radiello samples. Dataset concentrations were more dispersed for the Ferm data with some samples being below zero following blank subtractions.

Radiello sampling was selected for continuation of the gas monitoring for the second year of the WADMP.

3.1.5 Dry deposition rates - gases

Dry deposition rates of the acid gases were calculated from the gas concentrations determined by Radiello sampling at the five monitoring sites across the year. The annual dry deposition calculated for each monitoring site is summarised in Table 3.9 and illustrated in Figure 3.19. Total annual deposition was calculated from the combined rates for NH_3, NO_2, SO_2 and HNO_3. The composition of the total annual dry deposition is illustrated in Figure 3.20.

Table 3.9: Annual dry deposition rates

Annual deposition rates meq/m²/year					
	Visitor Centre	KBSF Quarry	AAQ station	Mt Wongama	RT Pastoral Lease
$NO_3^{(-1)}$	4.1	3.1	3.7	4.9	2.4
$SO_4^{(-2)}$	1.0	0.50	0.71	0.66	0.3
$NH_4^{(+1)}$	7.2	20.0	8.4	5.8	6.1
$NO_2^{(-1)}$	5.4	7.8	5.0	4.0	2.7
Total dry deposition	17.6	31.4	17.8	15.4	11.5

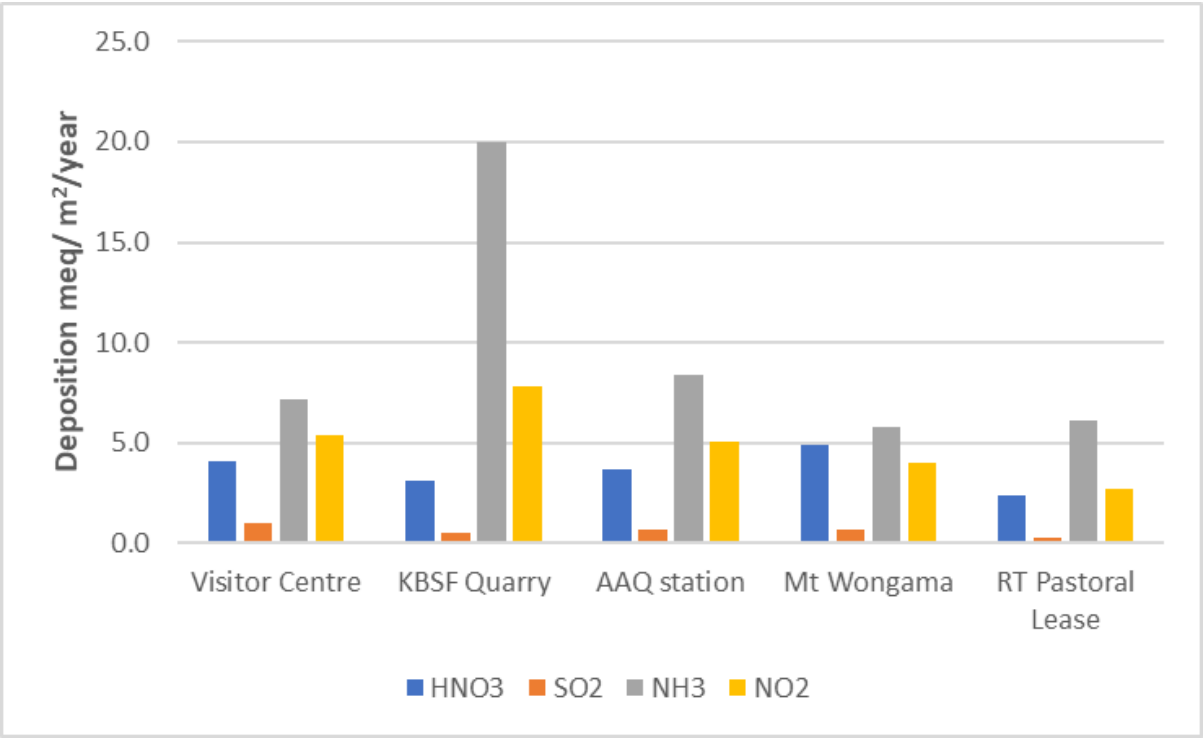

Figure 3.19: Annual deposition

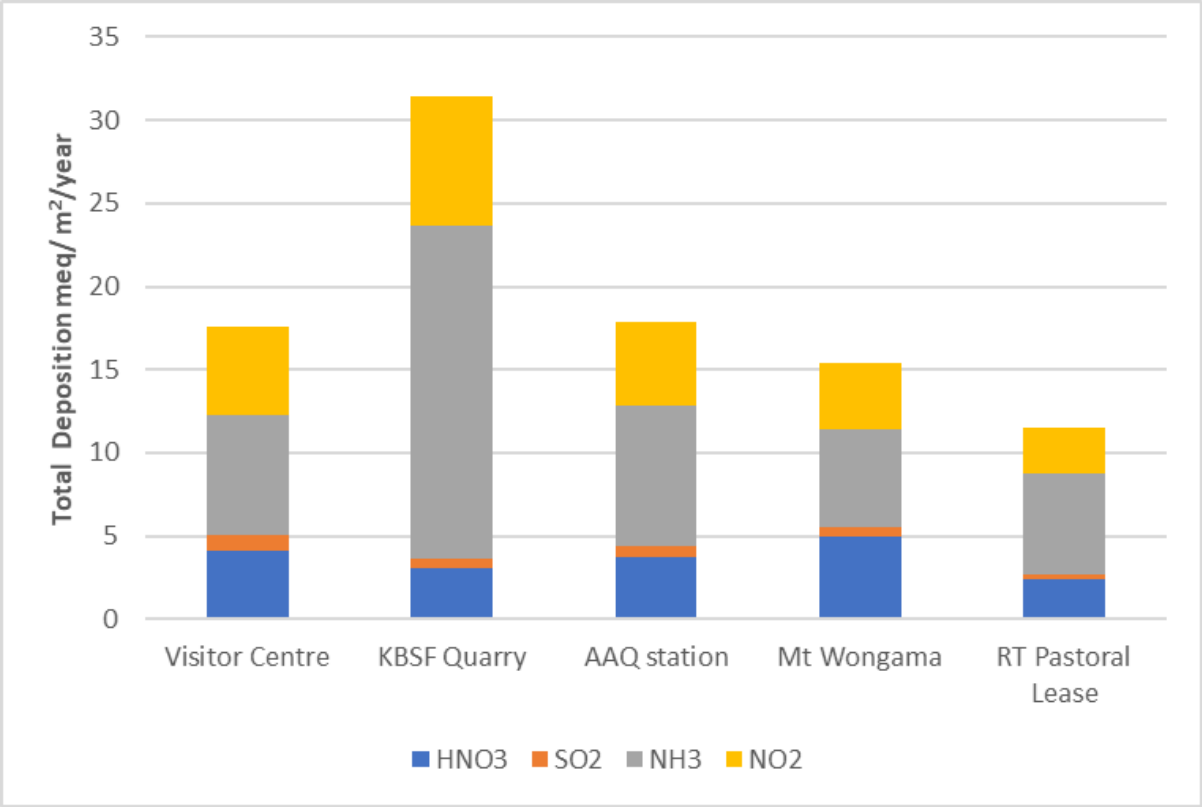

Figure 3.20: Total annual deposition composition

As expected from the concentration data, the sites closest to industrial emissions sources recorded the highest dry deposition. Deposition is greatest at KBSF Quarry where the highest deposition of both NOx and NH_3 are recorded.

NH_3 comprises the most significant contribution to the total deposition at all sites. In particular, the deposition at the RT Pastoral Lease site appears high for a site anticipated not to have a significant ammonia source. While nearby cattle could contribute some NH_3 to atmosphere via microbial decomposition of uric acid, urea and undigested protein in faeces (expected to be negligible in grass fed cattle), this is expected to be very low in the predominantly dry conditions and given that the land surrounding the monitoring site is unimproved pasture that is unlikely to receive any nitrogen fertiliser.

The apparent high contribution of NH_3 to the acid species deposition at all sites may be driven by the adopted deposition velocity (0.0095 m sec^{-1}). Deposition velocities used for the calculations were as adopted for the Burrup Peninsula Air Pollution Study (CSIRO 2010, Gillet *et al* 2012). These deposition velocities are not specific to the Murujuga atmospheric environment or land use and may not be representative of the actual deposition of the gases occurring. Further investigation of this issue is outside the current scope of the WADMP; however, it is noted that the NH_3 deposition velocity appears to be derived from a forest environment[2] and thus may be overly conservative leading to inflation of the actual acid deposition number[3].

3.2 Meteorological parameters

Meteorological conditions can influence ambient air quality sampling. Specifically, passive sampling may be influenced by extreme humidity (<10% or > 90%), high temperatures (Radiello specify that sampling for gases is independent of temperature between 0-39 ^oC), and strong winds (>10m/s).

The valid data capture rates for the monitored meteorological parameters across the year were greater than 99% at the KSBSF Quarry, Mt Wongama and Visitor Centre sites. Data capture at AAQ Station (95%) was lower due to the monthly maintenance at the site interrupting the total data capture; however, the data capture is 100% of available data; i.e., there were no equipment malfunctions leading to loss of data. Some data loss at the RT Pastoral Lease site occurred due to a wind sensor malfunction from 18 May 2022 to 1 June 2022.

The measured weather data was examined to determine if these conditions had occurred during the reporting period.

[2] Ammonia deposition velocity referenced from Puxbaum H. and Gregori M., (1998) Seasonal and annual deposition rates of sulfur, nitrogen and chloride species to an oak forest in north-eastern Austria (Wolkersdorf, 240 m A.S.L.), Atmospheric Environment, 32, 3557 –3558. Deposition velocities for nitrogen dioxide, sulfur dioxide and nitric acid of 0.0090 m sec-1, 0.0028 m sec-1 and 0.0021 m sec-1 respectively are from Manins, P.C.(1994) Modelling dry deposition in the Klang Valley. Workshop on acid rain network in South, East and Southeast Asia (ARNSESEA), 17 – 19 May 1994, Federal Hotel, Kuala Lumpur, Malaysia. Malaysian Scientific Association and others.

[3] Comment informed by the relative deposition of forest deposition being higher relative to agricultural/urban land use reported by Schrader F, Brümmer C. (2014) Land Use Specific Ammonia Deposition Velocities: a Review of Recent Studies (2004-2013). Water Air Soil Pollut.;225(10):2114.

3.2.1 Wind

Wind speed and directions were measured at all sites. The maximum wind speed detected at each site for the reporting period is detailed below (Table 3.10).

Table 3.10: Maximum recorded windspeeds

Start date	End date	KBSF Quarry WS max m/s	Mt Wongama WS max m/s	Visitor Centre WS max m/s	RT Pastoral Lease WS max m/s	AAQ Station WS max m/s
5/10/2021	14/10/2021	7.6	11.2	8.4	9.1	9.7
14/10/2021	1/11/2021	6.8	12.4	7.9	8.9	8.7
1/11/2021	15/11/2021	8.1	11.7	8.6	8.9	10.0
15/11/2021	29/11/2021	7.7	13.0	8.0	9.7	9.5
29/11/2021	13/12/2021	6.9	11.2	6.9	9.2	8.8
13/12/2021	29/12/2021	7.4	14.1	7.6	11.0	9.2
29/12/2021	12/01/2022	6.2	13.5	7.4	12.5	9.4
12/01/2022	25/01/2022	7.1	12.0	8.7	9.7	8.9
25/01/2022	9/02/2022	8.2	13.6	8.5	9.2	9.9
9/02/2022	23/02/2022	7.7	18.1	10.7	11.3	12.1
23/02/2022	9/03/2022	7.7	14.2	8.4	10.6	9.9
9/03/2022	23/03/2022	6.3	13.9	7.8	9.0	9.0
23/03/2022	5/04/2022	5.9	12.8	9.1	9.1	8.8
5/04/2022	20/04/2022	7.5	11.1	8.3	8.9	9.7
20/04/2022	4/05/2022	6.6	10.0	7.8	7.6	9.1
4/05/2022	19/05/2022	8.8	11.3	9.6	8.0	11.7
19/05/2022	1/06/2022	9.8	17.2	11.6	-	14.3
1/06/2022	15/06/2022	8.3	10.6	9.3	6.8	11.5
15/06/2022	29/06/2022	6.8	10.6	7.0	7.1	8.7
29/06/2022	18/07/2022	8.9	11.9	9.2	8.4	11.2
18/07/2022	27/07/2022	7.2	10.4	7.8	6.4	8.8
27/07/2022	10/08/2022	6.7	11.5	6.9	8.7	8.3
10/08/2022	24/08/2022	8.1	10.7	9.1	8.5	11.2
24/08/2022	4/09/2022	8.5	10.8	8.7	10.0	10.4

Winds exceeding speeds of 10 m/s, which may influence the passive sampling[4], occurred most frequently at Mt Wongama, which is at an elevated and exposed position (Figure 3.23 to Figure 3.24). As sampling at Mt Wongama can, on occasion, be influenced by the strong winds, it is expected that this location would have lower concentrations than other sites due to effective dilution. However, it is not possible to discern whether lower recorded concentrations are attributable to dilution or ineffective passive sampling. Given the frequency of winds above 10 m/s occurred for only 1.9% during the first year of sampling, it is unlikely that the results have been unduly influenced by elevated wind conditions.

Quarterly wind roses are presented for the Mt Wongama site (Figure 3.21). Wind roses for the (Radiello) sampling periods at all sites are presented in Appendix A. Prevailing winds at all sites were typically from the east from April 2022 through August 2022 and from the west for the rest of the year.

The RT Pastoral Lease site, which is situated inland in an exposed position on open flat ground, experienced occasional strong winds. However, prevailing conditions were typically below 8 m/s and similar to the other monitoring sites. The RT Pastoral Lease and AAQ Station experienced similar wind speeds (Figure 3.26 to Figure 3.28), while KBSF Quarry and Visitor Centre experienced slightly lower wind speeds due to more sheltered locations (not illustrated).

[4] Radiello manual cites sampling rate is invariant between wind speeds of 0.1 and 10 m/s.

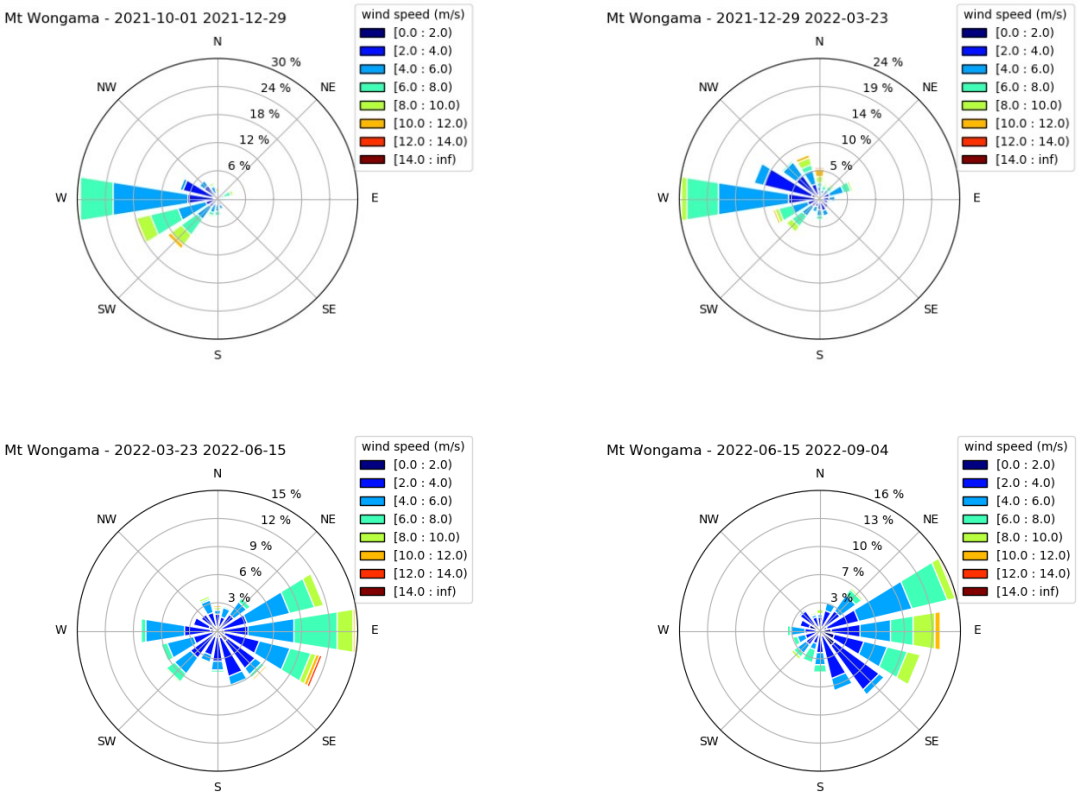

Figure 3.21: Quarterly wind roses Mt Wongama

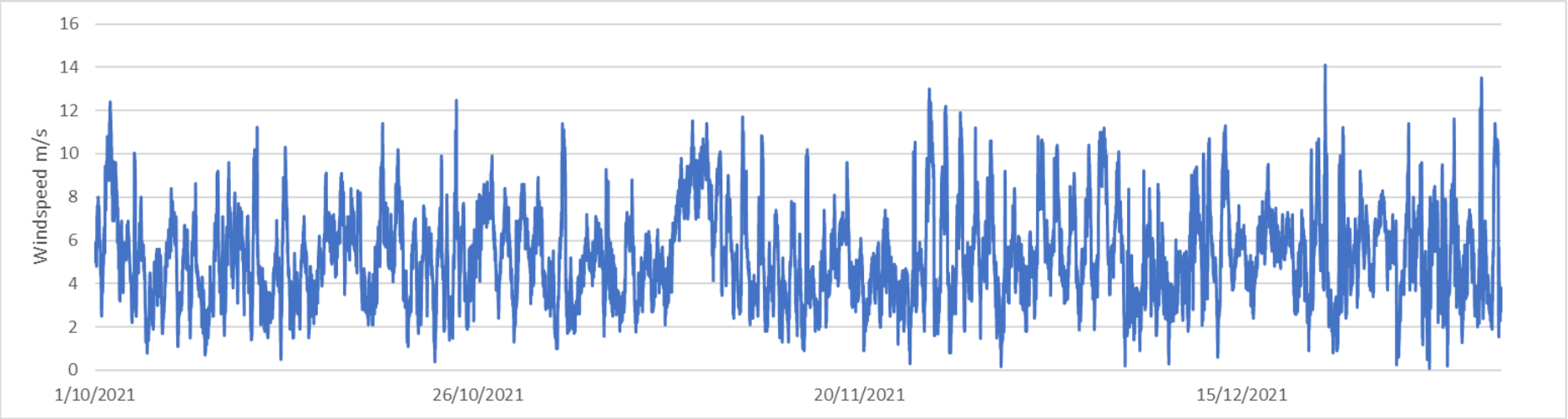

Figure 3.22: Wind speed recorded at Mt Wongama Quarter 1

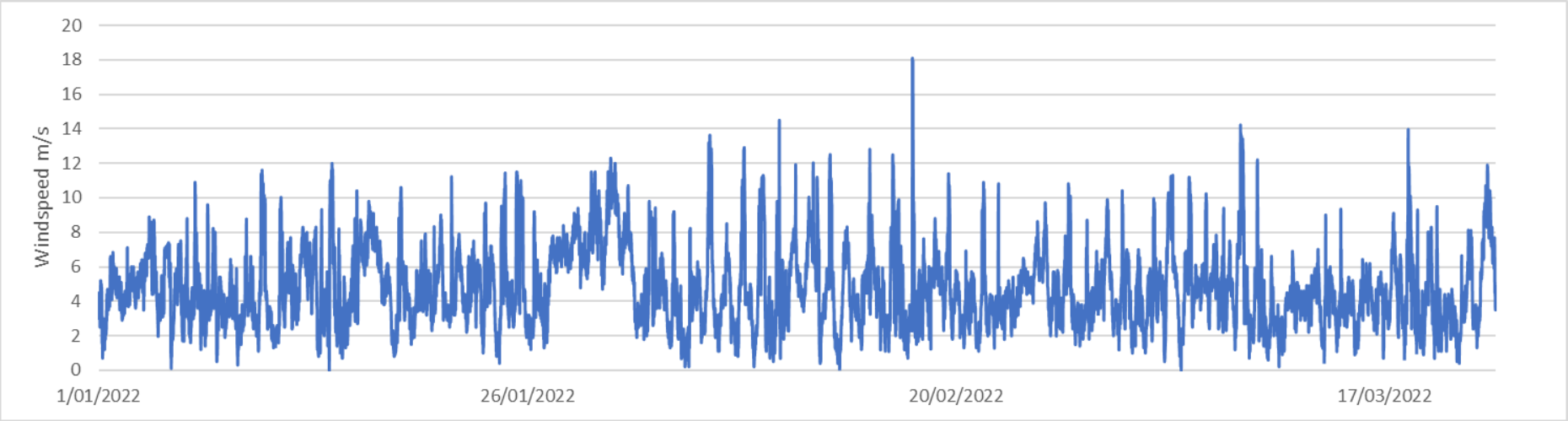

Figure 3.23: Wind speed recorded at Mt Wongama Quarter 2

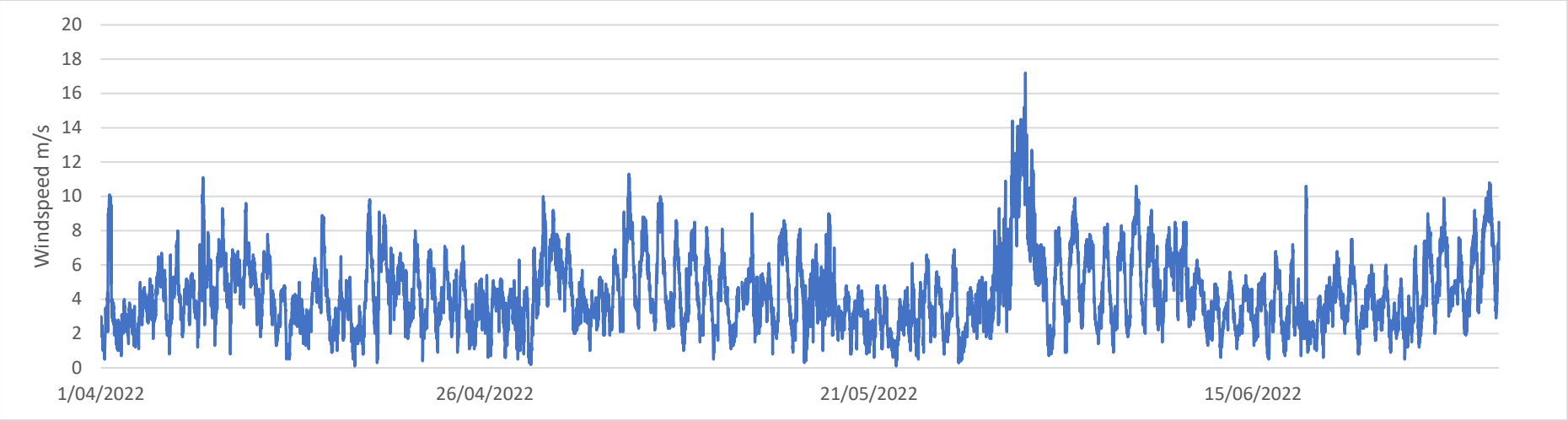

Figure 3.24: Wind speed recorded at Mt Wongama Quarter 3

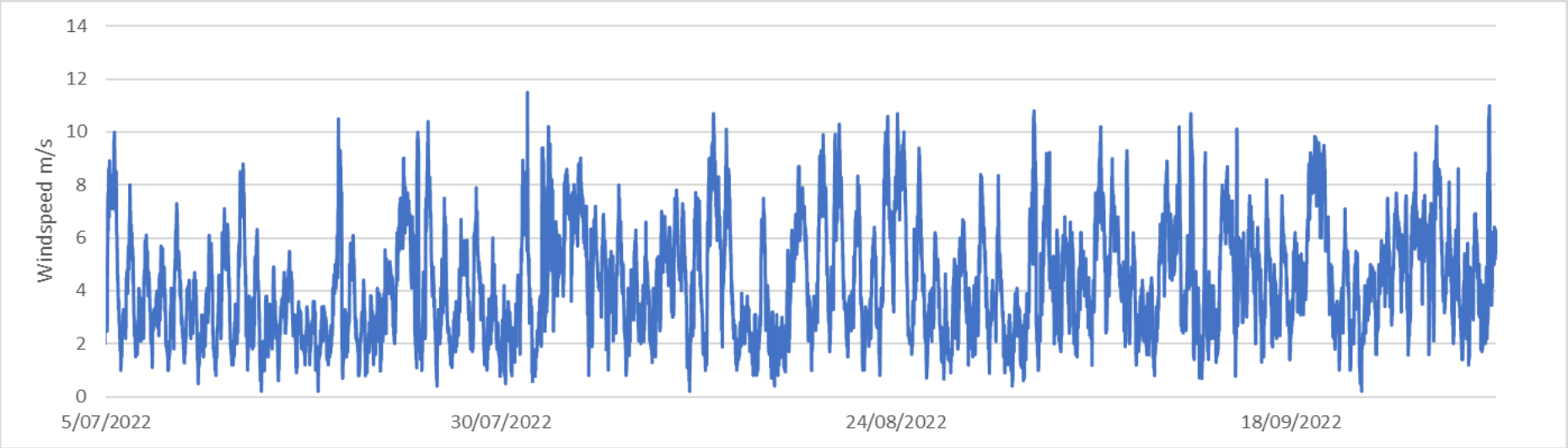

Figure 3.25: Wind speed recorded at Mt Wongama Quarter 4

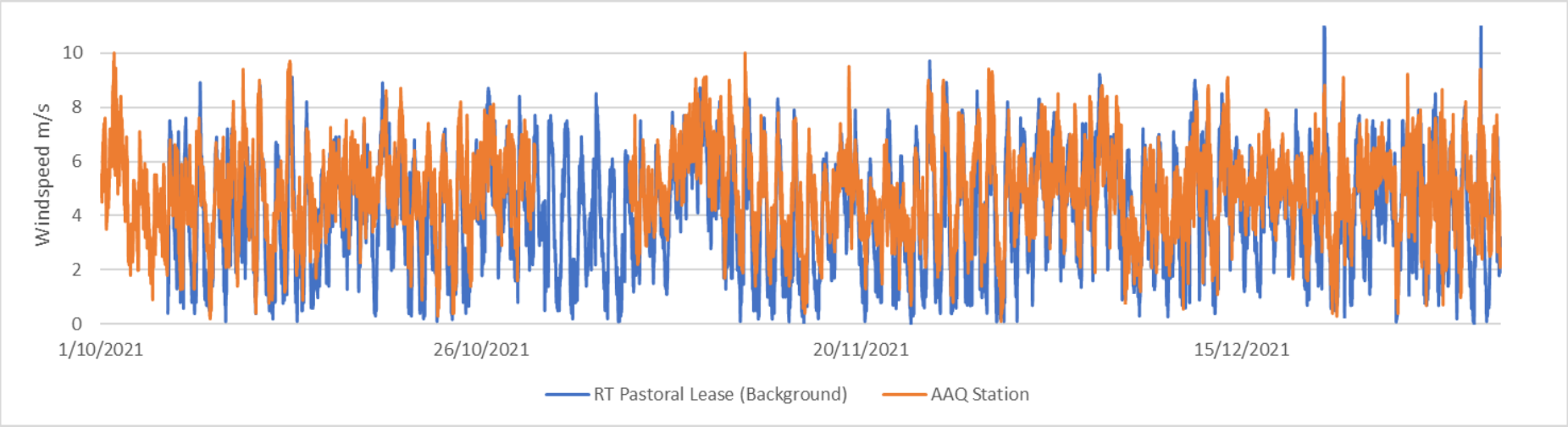

Figure 3.26: Wind speed at RT Pastoral Lease and AAQ Station Quarter 1

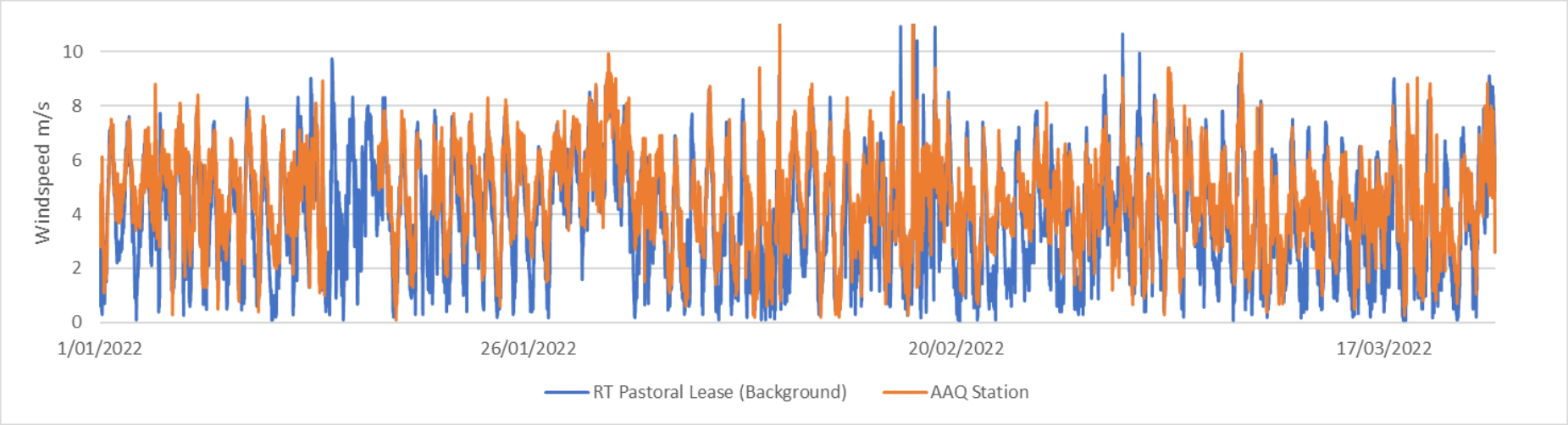

Figure 3.27: Wind speed at RT Pastoral Lease and AAQ Station Quarter 2

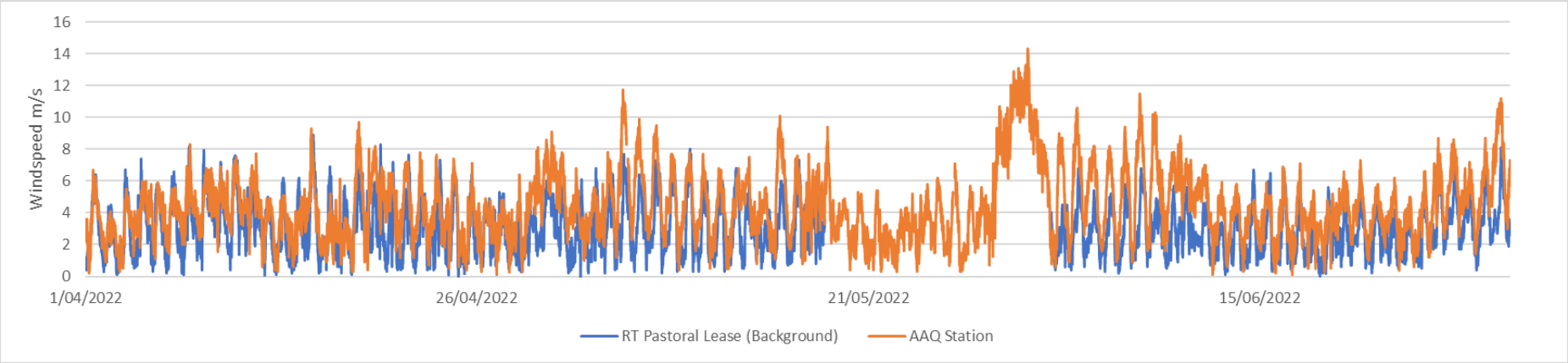

Figure 3.28: Wind speed at RT Pastoral Lease and AAQ Station Quarter 3

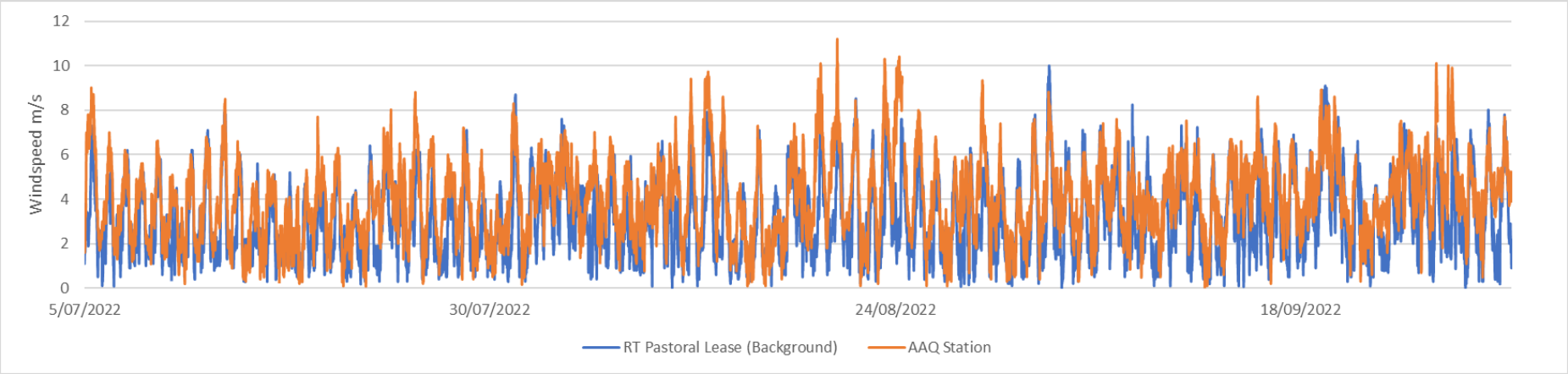

Figure 3.29: Wind speed at RT Pastoral Lease and AAQ Station Quarter 4

3.2.2 Temperature and humidity

Temperature was monitored at the AAQ Station, representative of conditions on lower Murujuga, and at RT Pastoral Lease, which is located inland and not subject to the coastal conditions experienced at the other sites. The temperature data was used to adjust the Radiello NO_2 data, which is subject to temperature-dependent uptake. The same correction was applied to HNO_3, which is assumed to have the same diffusion characteristics as NO_2. The Ferm data was also corrected (by the laboratory) for average ambient temperature. A summary of the average and maximum recorded temperatures is presented in Table 3.11.

Table 3.11: Average and maximum recorded temperature

Start date	End date	Temperature (°C)			
		RT Pastoral Lease		AAQ Station	
		Average	Maximum	Average	Maximum
5/10/2021	14/10/2021	26.3	38.0	25.5	33.4
14/10/2021	1/11/2021	26.3	39.7	25.7	37.1
1/11/2021	15/11/2021	26.0	37.2	25.6	32.7
15/11/2021	29/11/2021	29.5	42.5	28.3	37.5
29/11/2021	13/12/2021	33.5	46.6	30.7	41.8
13/12/2021	29/12/2021	31.9	44.7	29.6	38.4
29/12/2021	12/01/2022	30.5	42.9	28.9	35.7
12/01/2022	25/01/2022	32.4	50.4	20.9	46.2
25/01/2022	9/02/2022	30.3	39.0	27.7	35.6
9/02/2022	23/02/2022	32.2	45.0	30.4	38.6
23/02/2022	9/03/2022	33.2	45.9	31.1	38.6
9/03/2022	23/03/2022	33.5	45.6	32.3	41.4
23/03/2022	5/04/2022	30.0	40.9	29.5	38.2
5/04/2022	20/04/2022	30.6	39.9	29.9	37.5
20/04/2022	4/05/2022	27.6	38.8	27.0	35.0
4/05/2022	19/05/2022	25.0	36.5	24.8	32.5
19/05/2022	1/06/2022	22.8	32.1	22.5	28.9
1/06/2022	15/06/2022	21.7	30.9	21.4	26.1
15/06/2022	29/06/2022	22.4	32.3	23.2	28.4
29/06/2022	18/07/2022	18.2	30.2	19.7	26.1
18/07/2022	27/07/2022	20.3	30.6	21.7	28.4
27/07/2022	10/08/2022	21.1	31.6	21.6	27.3
10/08/2022	24/08/2022	22.1	33.2	22.9	29.6
24/08/2022	4/09/2022	22.0	31.7	22.2	28.4

Temperatures, illustrated in Figure 3.30 to Figure 3.33, experienced a broader diurnal swing at the inland RT Pastoral Lease site relative to lower Murujuga across the year and exceeded 39 °C on several days (3.4% of total time).

Conditions at the sites located on lower Murujuga only experienced temperatures above 39 °C for 0.2% of the total reporting duration. Radiello reports a negligible effect of temperature between 2-39 °C for NH_3 and -10-40 °C for SO_2. Since the temperatures were largely within the range of invariant sampling rate, the Radiello data for NH_3 and SO_2 were not subject to temperature correction.

Relative humidity (RH) above 90% and below 10% can interfere with passive sampling methods. During the monitoring period, RH was predominantly within the 10-90% range. The maximum RH was typically lower at the inland RT Pastoral Lease site (Figure 3.34 to Figure 3.37). Humidity was recorded above 90% for 2.7% and 2.5% of the monitoring period for RT Pastoral Lease site and AAQ Station respectively.

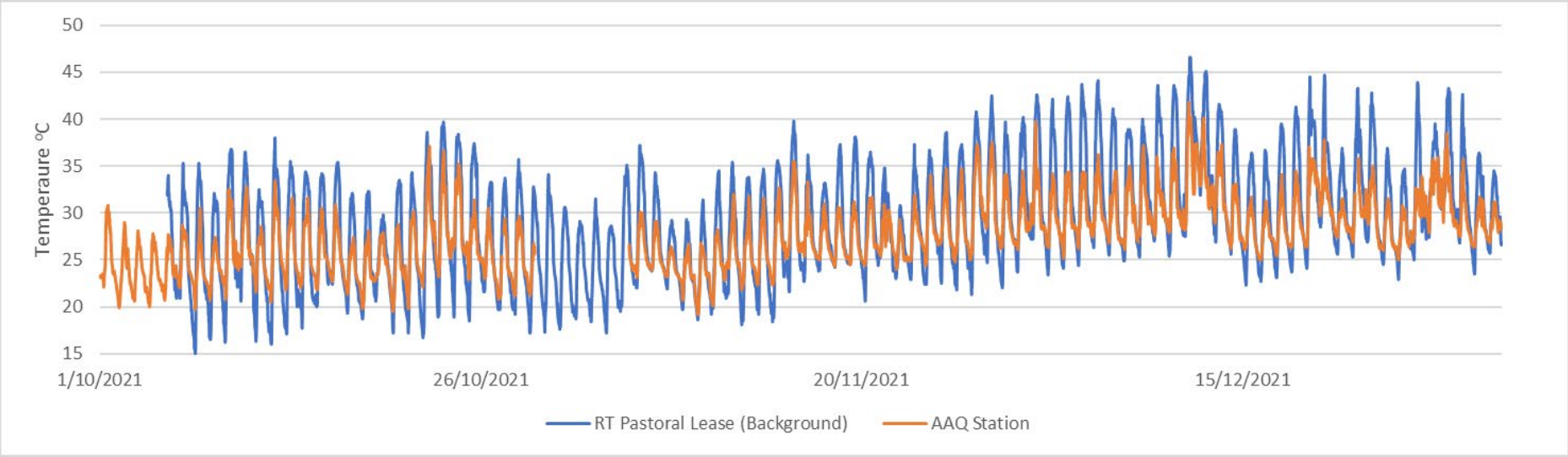

Figure 3.30: Ambient temperature at RT Pastoral Lease and AAQ Station Quarter 1

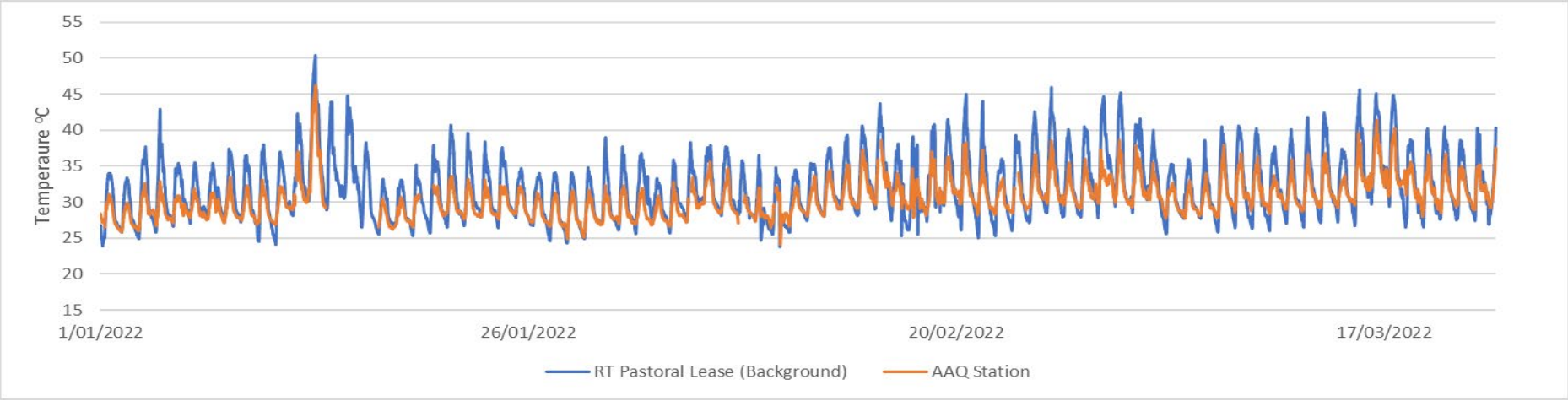

Figure 3.31: Ambient temperature at RT Pastoral Lease and AAQ Station Quarter 2

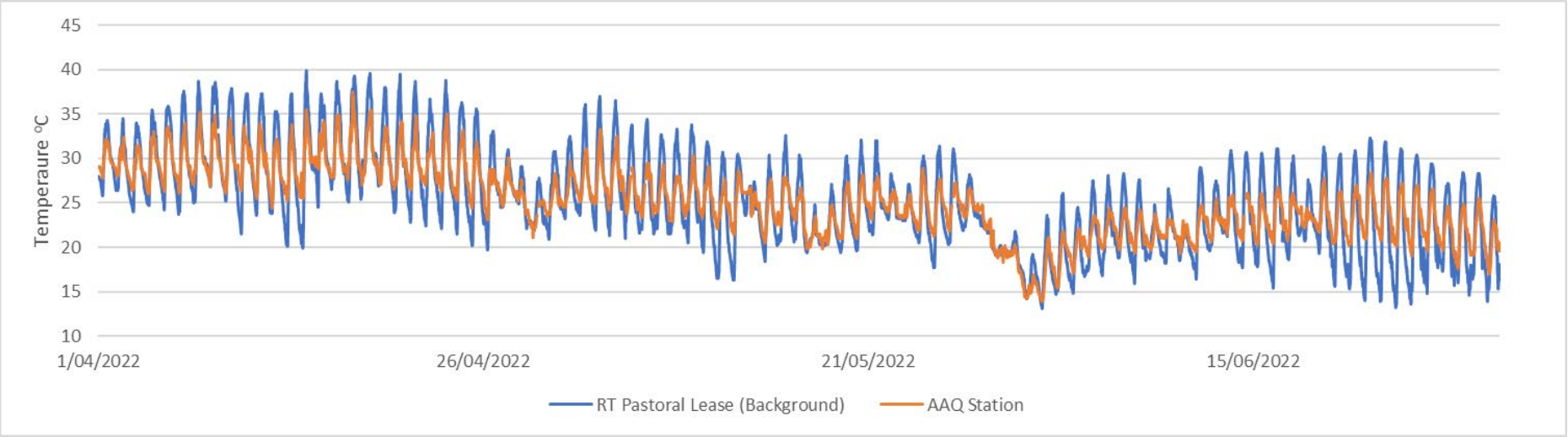

Figure 3.32: Ambient temperature at RT Pastoral Lease and AAQ Station Quarter 3

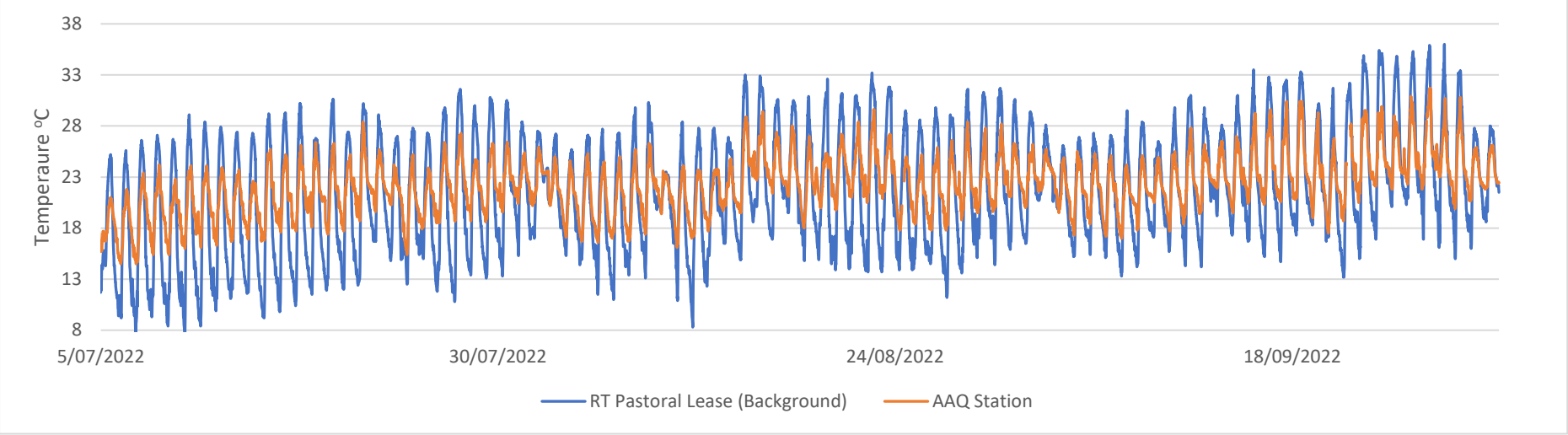

Figure 3.33: Ambient temperature at RT Pastoral Lease and AAQ Station Quarter 4

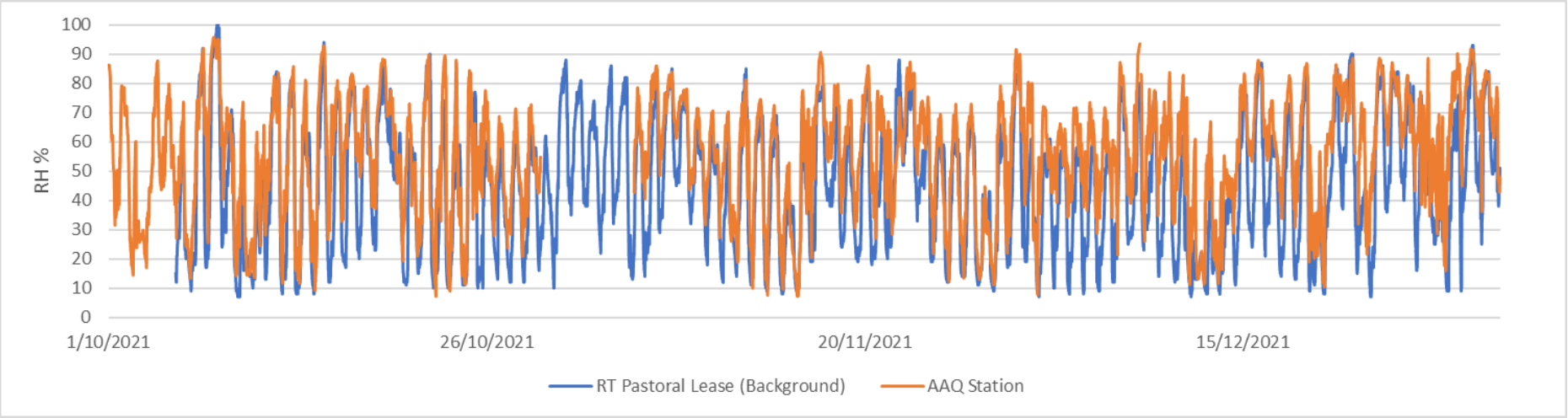

Figure 3.34: Relative humidity at RT Pastoral Lease and AAQ Station Quarter 1

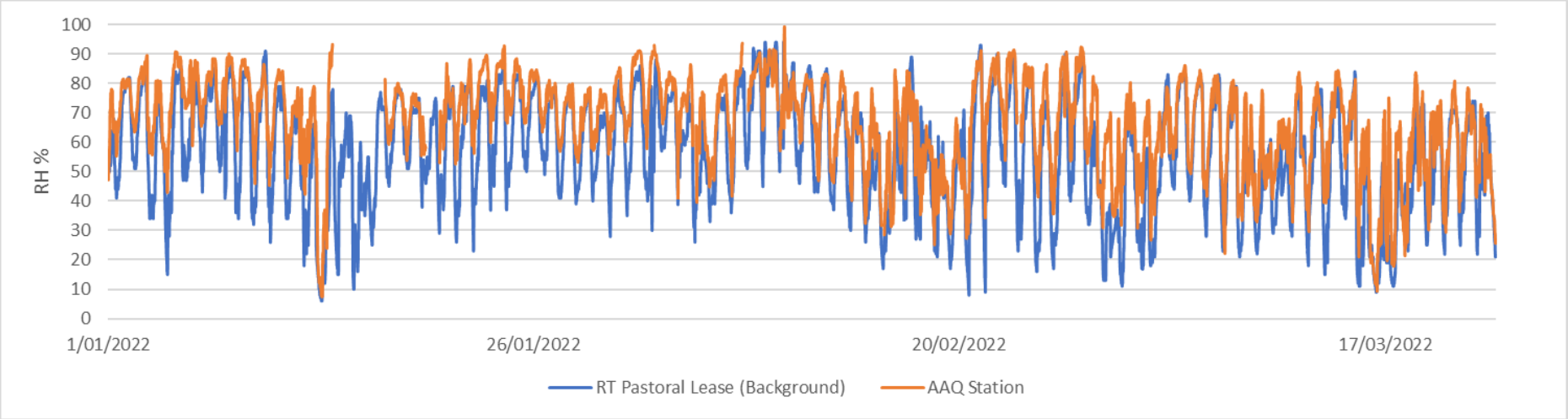

Figure 3.35: Relative humidity at RT Pastoral Lease and AAQ Station Quarter 2

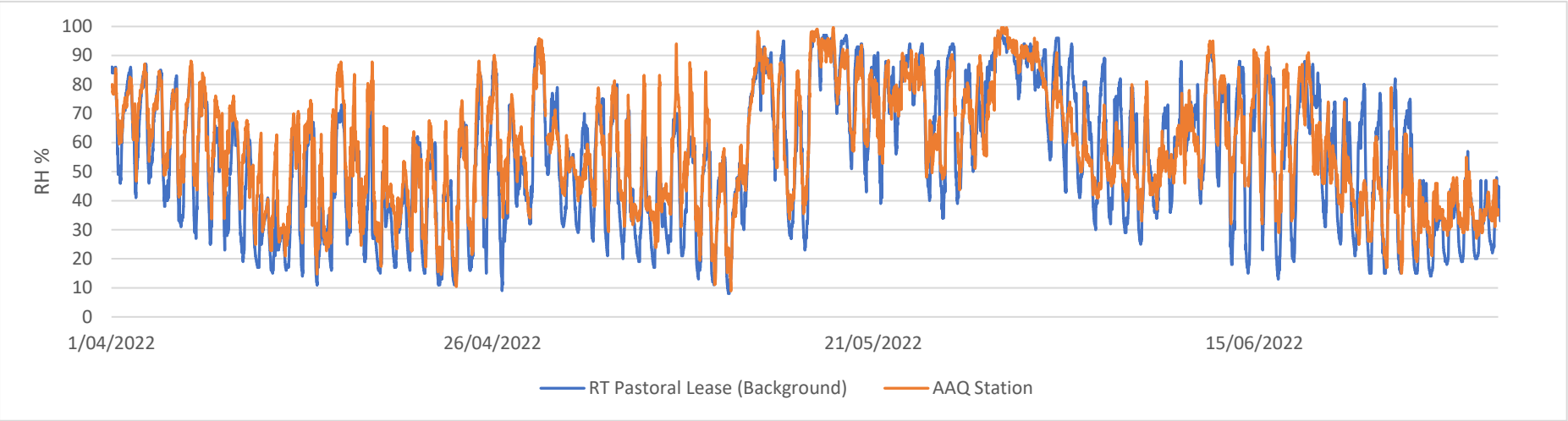

Figure 3.36: Relative humidity at RT Pastoral Lease and AAQ Station Quarter 3

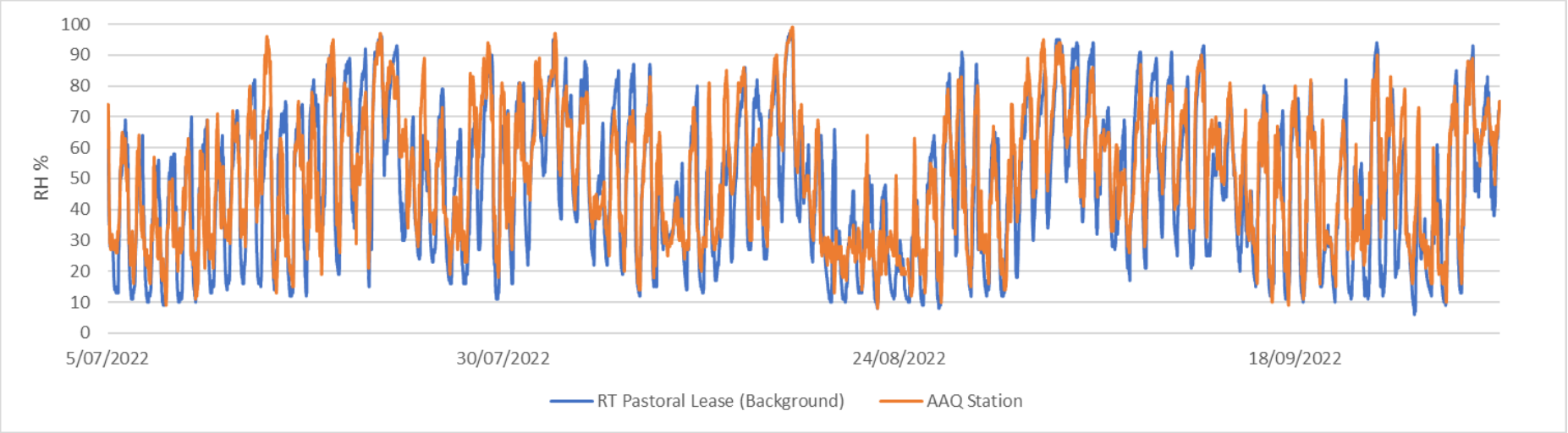

Figure 3.37: Relative humidity at RT Pastoral Lease and AAQ Station Quarter 4

3.3 Deposited dust

Results of dust deposition monitoring at the five sites are shown in Figure 3.38 to Figure 3.41, illustrating the contribution of the soluble and insoluble fractions (dates are the commencement of each round of four week sampling).

The trends for each site across the entire monitoring period (twelve 30-day sampling rounds) is illustrated in Figure 3.42 to Figure 3.41.

While localised dust sources may influence the soluble to insoluble ratios, the five sites had similar ratios for most sampling periods implying the sampling is typically representative of the broader airshed rather than near field sources.

The exception was the RT Pastoral Lease site maximum (7.3 g/m^2/month), which occurred in February 2022 and had a high proportion of insoluble material likely to be crustal dust (i.e., particles of soil and rock lifted from the surface). Whilst rain occurred during this sampling period, a prolonged period of elevated winds was recorded prior (during the early part of the sampling). Furthermore, the monitoring station is in a stock paddock and, therefore, the movement of animals in the vicinity of the station during dry conditions and elevated winds could have further contributed to the high levels recorded.

The Mt Wongama maximum (6.7 g/m^2/month) was the highest recorded at the Murujuga monitoring sites and was contributed to by elevation of both soluble and insoluble fractions. This site is an elevated and exposed position compared to the other monitoring sites and, therefore, may be more exposed to marine aerosols and potential for wind-blown crustal dust from all directions.

KBSF Quarry experienced the next highest levels of deposited dust (5.8 g/m^2/month), with a spike in insoluble component compared to other samples at this site for the sample collected in Round 9 (May to June 2022). This round included a period from the evening on 21 May 2022 to the evening of 29 May 2022 when winds were more than 10 m/s at the AAQ Station (Figure 3.28). The area surrounding the KBSF Quarry monitoring location is largely un-stabilised material from the quarry with a higher potential for lift off by the wind than other sites.

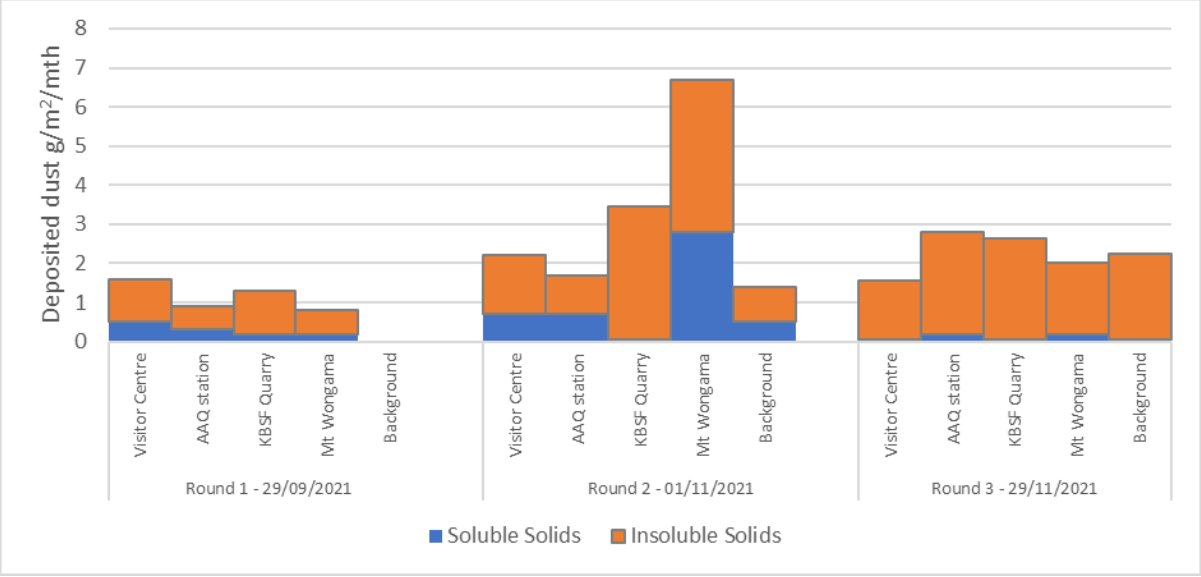

Figure 3.38: Deposited dust 29 September to 29 December 2021

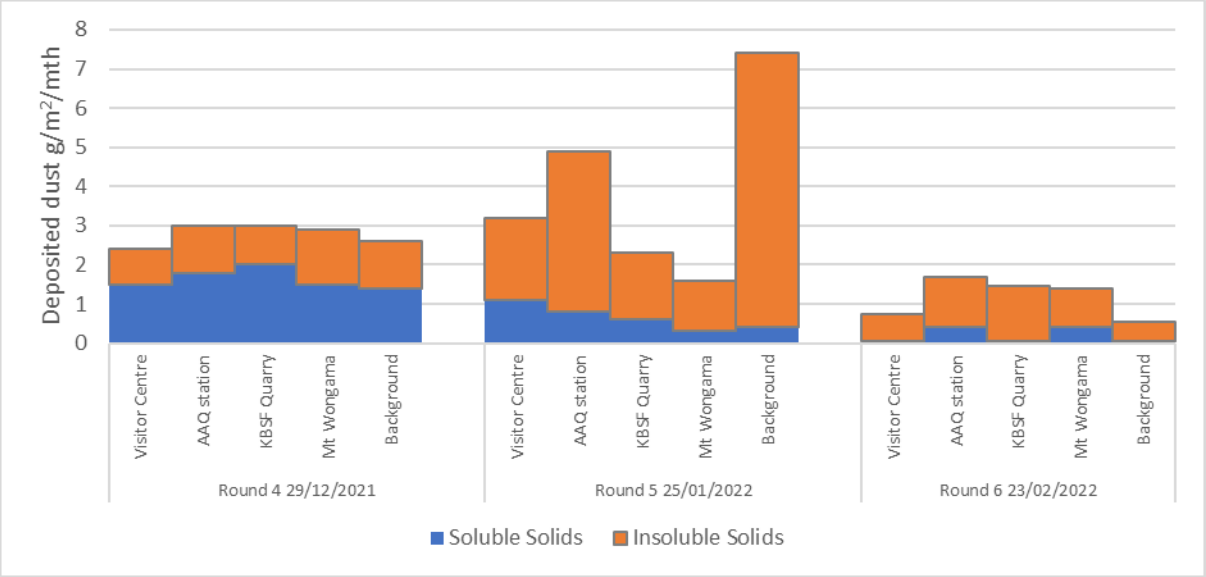

Figure 3.39: Deposited dust 29 November 2021 to 23 March 2022

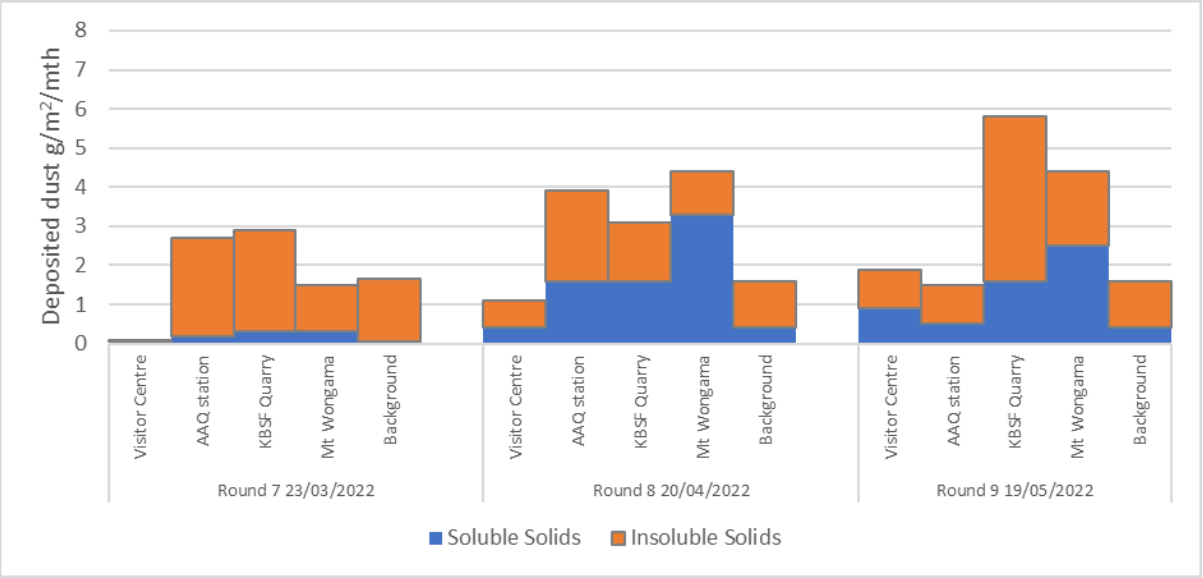

Figure 3.40: Deposited dust 23 March 2022– 15 June 2022

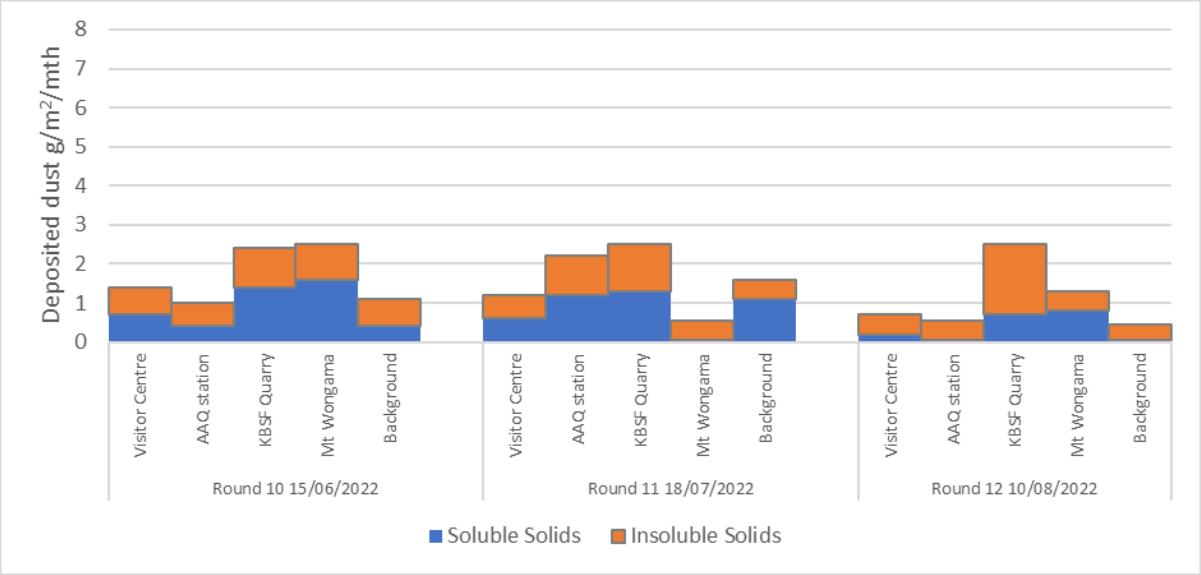

Figure 3.41: Deposited dust 15 June 2022– 4 September 2022

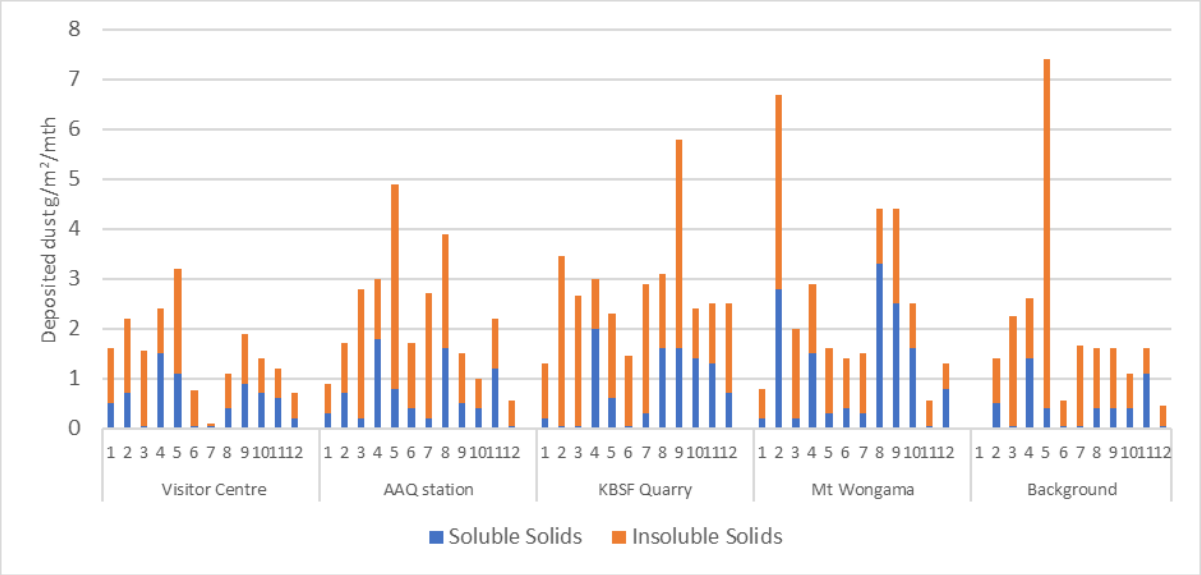

Figure 3.42: Deposited dust data site trends across the twelve sampling rounds

3.3.1 Soluble fraction deposition

The soluble fractions from the dust taken from the deposition gauges was analysed for anions and cations. The ion concentrations are provided in Table 3.12 and Table 3.13 and the mass concentration data is presented in Appendix D.

Total anions and cations are converted to deposition using the area of the funnel (0.018m^2) and the recorded volumes of liquid in the deposition gauges. Where the analyte concentration was below the limit of reporting, the limit of reporting is reported and used in the calculation of the maximum total cation and anion sums. The minimum sum is calculated from the detect values only. The true total is somewhere between the minimum and maximum deposition values in the tables.

Table 3.12: Soluble fraction cation concentrations

Start date	End Date	$NH_4^{(+1)}$	$Ca^{(+2)}$	$Mg^{(+2)}$	$K^{(+1)}$	$Na^{(+1)}$	Min Σ cations	Max Σ cations	Min Σ cations	Max Σ cations
		mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/m^2	mEq/m^2
KBSF Quarry										
29/09/2021	1/11/2021	< 0.01	0.55	0.09	0.015	0.32	0.97	0.98	20.08	20.23
29/11/2021	29/12/2021	< 0.004	0.32	0.06	0.008	0.29	0.68	0.68	17.62	17.73
29/12/2021	25/01/2022	< 0.004	0.13	0.03	< 0.01	0.29	0.45	0.47	13.90	14.26
25/01/2022	23/02/2022	0.004	0.09	0.03	< 0.01	0.09	0.21	0.22	9.30	9.46
23/02/2022	23/03/2022	< 0.001	0.08	0.04	0.003	0.18	0.31	0.31	8.86	8.90
23/03/2022	20/04/2022	< 0.001	0.21	0.05	0.008	0.21	0.48	0.48	17.10	17.16
20/04/2022	19/05/2022	< 0.001	0.08	0.02	< 0.003	0.11	0.21	0.22	24.14	24.59
19/05/2022	15/06/2022	0.006	0.06	0.02	0.005	0.21	0.31	0.31	43.47	43.47
15/06/2022	18/07/2022	< 0.001	0.16	0.06	< 0.01	0.26	0.48	0.50	14.22	14.64
18/07/2022	10/08/2022	< 0.001	0.15	< 0.04	< 0.01	0.16	0.32	0.37	8.93	10.50
10/08/2022	4/09/2022	0.001	0.22	0.11	0.018	0.19	0.54	0.54	15.20	15.20
Total									192.81	196.12
Visitor Centre										
29/09/2021	1/11/2021	0.04	0.80	0.17	0.03	0.71	1.75	1.75	19.85	19.85
29/11/2021	29/12/2021	0.02	0.27	0.09	0.01	0.61	1.00	1.00	26.15	26.15
29/12/2021	25/01/2022	< 0.00	0.10	0.04	0.01	0.28	0.43	0.44	12.33	12.45
25/01/2022	23/02/2022	0.01	0.16	0.08	0.01	0.30	0.57	0.57	24.08	24.08
23/02/2022	23/03/2022	0.01	0.05	0.02	0.01	0.14	0.24	0.24	7.28	7.28
23/03/2022	20/04/2022	0.00	0.05	0.03	0.01	0.07	0.16	0.16	4.90	4.90
20/04/2022	19/05/2022	0.01	0.03	0.02	< 0.003	0.04	0.10	0.10	11.01	11.29
19/05/2022	15/06/2022	0.00	0.06	0.02	0.00	0.10	0.18	0.18	25.82	25.82
15/06/2022	18/07/2022	0.01	0.06	< 0.04	0.03	0.07	0.18	0.22	5.02	6.18
18/07/2022	10/08/2022	< 0.001	0.13	< 0.04	< 0.01	0.20	0.33	0.38	9.21	10.78
10/08/2022	4/09/2022	< 0.001	0.08	< 0.04	< 0.01	0.03	0.11	0.17	1.31	1.97
Total									146.95	150.74
AAQ Station										
29/09/2021	1/11/2021	< 0.01	0.18	0.09	0.01	0.25	0.54	0.55	8.62	8.73
29/11/2021	29/12/2021	< 0.004	0.26	0.07	0.01	0.65	0.99	0.99	27.00	27.12
29/12/2021	25/01/2022	< 0.004	0.19	0.05	0.01	0.34	0.59	0.59	17.70	17.83
25/01/2022	23/02/2022	0.02	0.22	0.07	0.01	0.31	0.63	0.63	25.81	25.81
23/02/2022	23/03/2022	< 0.001	0.08	0.04	0.00	0.18	0.30	0.30	9.05	9.10
23/03/2022	20/04/2022	< 0.001	0.33	0.07	0.01	0.30	0.70	0.70	19.97	20.01
20/04/2022	19/05/2022	< 0.001	0.06	0.02	< 0.00	0.08	0.15	0.16	17.94	18.40
19/05/2022	15/06/2022	0.01	0.05	0.02	0.003	0.06	0.15	0.15	20.82	20.82

Start date	End Date	$NH_4^{(+1)}$	$Ca^{(+2)}$	$Mg^{(+2)}$	$K^{(+1)}$	$Na^{(+1)}$	Min Σ cations	Max Σ cations	Min Σ cations	Max Σ cations
		mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/m^2	mEq/m^2
15/06/2022	18/07/2022	< 0.001	0.07	< 0.04	< 0.01	0.09	0.16	0.21	3.99	5.40
18/07/2022	10/08/2022	< 0.001	0.12	< 0.04	< 0.01	0.14	0.26	0.32	7.47	9.03
10/08/2022	4/09/2022	< 0.001	0.09	< 0.04	< 0.01	0.06	0.15	0.20	4.31	5.94
Total									162.69	168.20
Mt Wongama										
29/09/2021	1/11/2021	0.01	0.29	0.07	0.02	0.50	0.88	0.88	14.40	14.40
29/11/2021	29/12/2021	< 0.004	0.28	0.06	0.01	0.61	0.96	0.96	29.65	29.79
29/12/2021	25/01/2022	< 0.004	0.20	0.05	0.01	0.57	0.82	0.83	22.63	22.75
25/01/2022	23/02/2022	0.003	0.21	0.06	0.01	0.43	0.72	0.72	21.32	21.32
23/02/2022	23/03/2022	< 0.001	0.05	0.02	0.00	0.15	0.23	0.24	7.03	7.07
23/03/2022	20/04/2022	0.002	0.18	0.04	0.01	0.19	0.42	0.42	13.15	13.15
20/04/2022	19/05/2022	0.01	0.08	0.05	0.01	0.19	0.34	0.34	33.42	33.42
19/05/2022	15/06/2022	< 0.001	0.05	0.05	0.01	0.30	0.40	0.40	55.48	55.68
15/06/2022	18/07/2022	< 0.001	0.11	0.05	< 0.01	0.21	0.38	0.38	11.20	11.25
18/07/2022	10/08/2022	< 0.001	0.12	< 0.04	< 0.01	0.13	0.31	0.31	9.60	9.65
10/08/2022	4/09/2022	< 0.001	0.10	< 0.04	< 0.01	0.08	0.24	0.24	6.97	7.02
Total									224.88	225.50
RT Pastoral Lease										
29/09/2021	1/11/2021	-	-	-	-	-	-	-	-	-
29/11/2021	29/12/2021	0.005	0.47	0.38	0.04	0.70	1.58	1.58	31.83	31.83
29/12/2021	25/01/2022	0.01	0.26	0.03	0.01	0.32	0.64	0.64	15.52	15.52
25/01/2022	23/02/2022	0.02	0.12	0.02	0.01	0.10	0.27	0.27	19.82	19.82
23/02/2022	23/03/2022	0.03	0.06	0.04	0.03	0.08	0.23	0.23	7.06	7.06
23/03/2022	20/04/2022	0.01	0.18	0.03	0.01	0.15	0.38	0.38	10.89	10.89
20/04/2022	19/05/2022	-	-	-	-			-	0.00	
19/05/2022	15/06/2022	0.03	0.02	< 0.01	0.01	0.01	0.07	0.07	17.71	17.71
15/06/2022	18/07/2022	0.002	0.05	< 0.04	< 0.01	0.03	0.03	0.14	0.92	4.00
18/07/2022	10/08/2022	< 0.001	0.11	< 0.04	< 0.01	0.12	0.23	0.29	6.57	8.14
10/08/2022	4/09/2022	0.002	0.17	< 0.04	< 0.01	0.03	0.21	0.27	5.63	7.06
Total									115.94	122.02
- Data not available										

Table 3.13: Soluble fraction anion concentrations

Start date	End Date	$HCO_3^{(-1)}$	$Cl^{(-1)}$	$PO_4^{(-3)}$	$NO_3^{(-1)}$	$NO_2^{(-1)}$	$SO_4^{(-2)}$	NSS $SO_4^{(-2)}$	Min Σ anions	Max Σ anions	Min Σ anions	Max Σ anions
		mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/m²	mEq/m²
KBSF Quarry												
29/09/2021	1/11/2021	< 0.25	< 0.705	-	< 0.004	< 0.004	< 0.10	< 0.06	0.00	1.02	0.00	20.98
29/11/2021	29/12/2021	0.40	< 0.42	-	< 0.002	< 0.002	0.08	0.05	0.53	0.88	13.84	22.80
29/12/2021	25/01/2022	< 0.15	< 0.42	-	< 0.002	< 0.002	< 0.06	< 0.05	0.00	0.62	0.00	18.97
25/01/2022	23/02/2022	0.12	< 0.28	-	< 0.001	< 0.001	< 0.04	< 0.02	0.12	0.43	5.14	18.52
23/02/2022	23/03/2022	< 0.05	0.34	< 0.0003	< 0.001	< 0.001	< 0.02	0	0.34	0.39	9.77	11.25
23/03/2022	20/04/2022	0.12	< 0.14	< 0.0003	< 0.001	< 0.001	< 0.02	0	0.00	0.26	0.00	9.32
20/04/2022	19/05/2022	0.10	< 0.14	< 0.0003	0.008567	< 0.001	0.03	0.01	0.15	0.26	16.81	29.83
19/05/2022	15/06/2022	< 0.05	< 0.14	< 0.0003	< 0.001	< 0.001	0.02	0.01	0.04	0.20	5.12	28.31
15/06/2022	18/07/2022	0.07	0.25	< 0.0003	0.000714	< 0.001	0.04	0.01	0.37	0.33	10.87	9.74
18/07/2022	10/08/2022	0.06	< 0.14	0.0003	< 0.001	< 0.001	< 0.02	< 0.01	0.06	0.21	1.58	5.90
10/08/2022	4/09/2022	0.07	< 0.14	0.0003	< 0.001	< 0.001	< 0.02	0	0.07	0.21	1.94	5.97
Total											65.07	181.59
Visitor Centre												
29/09/2021	1/11/2021	< 0.25	< 0.71	-	< 0.004	< 0.004	< 0.10	< 0.01	0.00	0.97	0.00	11.00
29/11/2021	29/12/2021	< 0.15	< 0.42	-	< 0.002	< 0.002	< 0.06	< 0.01	0.00	0.59	0.00	15.37
29/12/2021	25/01/2022	< 0.15	< 0.42	-	< 0.002	< 0.002	< 0.06	< 0.04	0.00	0.62	0.00	17.62
25/01/2022	23/02/2022	0.06	0.34	-	< 0.001	< 0.001	0.06	0.02	0.48	0.42	20.20	17.76
23/02/2022	23/03/2022	< 0.05	< 0.14	< 0.0006	0.01	< 0.001	< 0.02	< 0.01	0.01	0.21	0.20	6.30
23/03/2022	20/04/2022	< 0.10	< 0.14	< 0.0013	0.002	0.001	< 0.02	< 0.003	0.00	0.25	0.11	7.58
20/04/2022	19/05/2022	< 0.05	< 0.14	< 0.0003	0.01	< 0.001	< 0.02	< 0.01	0.01	0.21	0.93	23.06
19/05/2022	15/06/2022	< 0.05	< 0.14	< 0.0003	0.0050	< 0.001	< 0.02	< 0.01	0.00	0.21	-0.71	29.52
15/06/2022	18/07/2022	0.06	< 0.14	< 0.0003	< 0.001	< 0.001	< 0.02	< 0.02	0.06	0.22	1.57	6.20
18/07/2022	10/08/2022	0.08	0.14	< 0.0003	< 0.001	< 0.001	0.02	< 0.02	0.22	0.24	6.23	6.92
10/08/2022	4/09/2022	0.05	< 0.14	< 0.0003	< 0.001	< 0.001	< 0.02	< 0.02	0.05	0.22	0.62	2.57
Total											29.15	143.89
AAQ Station												
29/09/2021	1/11/2021	< 0.002	< 0.71	-	< 0.004	< 0.004	< 0.10	< 0.06	0.00	0.77	0.00	12.30
29/11/2021	29/12/2021	< 0.15	< 0.42	-	< 0.002	< 0.002	< 0.06	< 0.03	0.00	0.60	0.00	16.49
29/12/2021	25/01/2022	< 0.15	< 0.28	-	< 0.002	< 0.002	< 0.06	< 0.04	0.00	0.47	0.00	14.13
25/01/2022	23/02/2022	0.05	< 0.141	-	< 0.001	< 0.001	0.07	0.03	0.03	0.23	1.31	9.40
23/02/2022	23/03/2022	< 0.05	< 0.141	< 0.0003	< 0.001	< 0.001	0.02	0	0.00	0.19	0.00	5.77
23/03/2022	20/04/2022	< 0.10	< 0.141	< 0.0003	0.001	0.001	< 0.02	0	0.00	0.24	0.04	6.91
20/04/2022	19/05/2022	< 0.05	< 0.141	< 0.0003	< 0.001	< 0.001	< 0.02	< 0.01	0.00	0.20	0.00	23.71
19/05/2022	15/06/2022	< 0.05	< 0.141	< 0.0003	< 0.001	< 0.001	< 0.02	< 0.01	0.00	0.20	0.00	27.73

Start date	End Date	$HCO_3^{(-1)}$	$Cl^{(-1)}$	$PO_4^{(-3)}$	$NO_3^{(-1)}$	$NO_2^{(-1)}$	$SO_4^{(-2)}$	NSS $SO_4^{(-2)}$	Min Σ anions	Max Σ anions	Min Σ anions	Max Σ anions
		mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/m²	mEq/m²
15/06/2022	18/07/2022	0.06	< 0.141	< 0.0003	< 0.001	< 0.001	< 0.02	< 0.02	0.00	0.23	0.00	5.78
18/07/2022	10/08/2022	0.07	< 0.141	< 0.0003	< 0.001	< 0.001	< 0.02	< 0.02	0.00	0.23	0.00	6.50
10/08/2022	4/09/2022	0.06	< 0.141	< 0.0003	< 0.001	< 0.001	< 0.02	< 0.02	0.00	0.22	0.00	6.47
Total											1.35	135.18
Mt Wongama												
29/09/2021	1/11/2021	< 0.25	< 0.71	-	< 0.001	< 0.001	< 0.10	< 0.07	0.00	1.02	0.00	16.73
29/11/2021	29/12/2021	< 0.15	< 0.42	-	< 0.001	< 0.001	< 0.06	< 0.03	0.00	0.60	0.00	18.76
29/12/2021	25/01/2022	0.19	< 0.42	-	< 0.001	< 0.001	< 0.06	< 0.04	0.19	0.65	5.16	17.81
25/01/2022	23/02/2022	0.05	0.31	-	< 0.001	< 0.001	< 0.04	< 0.01	0.36	0.38	10.83	11.21
23/02/2022	23/03/2022	< 0.05	< 0.14	< 0.0003	< 0.001	< 0.001	< 0.02	< 0.01	0.00	0.20	0.00	6.00
23/03/2022	20/04/2022	0.11	< 0.14	< 0.0003	< 0.001	< 0.001	< 0.02	0	0.11	0.25	3.39	7.83
20/04/2022	19/05/2022	0.07	0.21	< 0.0003	0.02	< 0.001	0.06	0.03	0.39	0.33	38.54	33.08
19/05/2022	15/06/2022	< 0.05	0.21	< 0.0003	< 0.001	< 0.001	0.04	0.02	0.27	0.28	37.26	38.58
15/06/2022	18/07/2022	0.09	0.23	< 0.0003	< 0.001	< 0.001	0.03	0.003	0.35	0.32	10.24	9.43
18/07/2022	10/08/2022	0.07	< 0.14	< 0.0003	< 0.001	< 0.001	< 0.02	< 0.02	0.07	0.23	2.19	7.28
10/08/2022	4/09/2022	0.06	0.15	< 0.0003	< 0.001	< 0.001	< 0.02	< 0.02	0.21	0.23	6.20	6.86
Total											113.80	173.57
RT Pastoral Lease												
29/09/2021	1/11/2021	-	-	-	-	-	-	-	-	-		-
29/11/2021	29/12/2021	0.18	< 0.42	-	< 0.002	< 0.002	0.21	0.01	0.39	0.61	7.92	12.32
29/12/2021	25/01/2022	< 0.15	< 0.42	-	< 0.002	< 0.002	0.06	0.05	0.11	0.62	2.62	15.11
25/01/2022	23/02/2022	0.13	< 0.28	-	< 0.001	< 0.001	< 0.04	< 0.03	0.13	0.44	9.53	32.77
23/02/2022	23/03/2022	0.06	< 0.14	0.001	0.01	< 0.00	< 0.02	0	0.07	0.21	2.00	6.29
23/03/2022	20/04/2022	0.10	< 0.14	< 0.0003	0.001	0.001	< 0.02	< 0.003	0.10	0.25	2.91	7.05
20/04/2022	19/05/2022	-	-	-	-	-	-	-		-		
19/05/2022	15/06/2022	< 0.049	< 0.14	0.002	< 0.001	< 0.001	< 0.02	< 0.02	0.00	0.21	0.38	52.15
15/06/2022	18/07/2022	0.07	< 0.14	< 0.0003	< 0.001	< 0.001	< 0.02	< 0.02	0.07	0.24	2.04	6.67
18/07/2022	10/08/2022	0.08	< 0.14	< 0.0003	< 0.001	< 0.001	< 0.02	< 0.02	0.08	0.24	2.24	6.87
10/08/2022	4/09/2022	0.06	< 0.14	0.0003	< 0.001	< 0.001	< 0.02	< 0.02	0.06	0.22	1.60	5.96
Total											31.25	145.18
- Data not available												

3.4 Rainfall

Rainfall samples were collected on 11 and 12 February 2022 after rain (21.2 mm) was recorded by the Bureau of Meteorology (BOM) Automatic Weather Station[5] at Karratha Airport on 9 and 10 February 2022. Samples at the RT Pastoral Lease site were not collected until 23 February 2022 due to the access track being unpassable.

Significant rainfall also occurred 17 May 2022 to 18 May 2022 (85 mm recorded by BOM), which was collected on 19 May 2022, except for the RT Pastoral Lease site, which was not accessible. Further rainfall (162 mm recorded by BOM) occurred between 29 May 2022 to 1 June 2022, and all outstanding samples were collected on 15 June 2022. The RT Pastoral Lease site was estimated as the same as the other sites for the last two months since the collection bucket had overflowed.

The rainfall collected across the year was analysed for cations and anions. One sample, collected at KBSF Quarry following the May 2022 rain event, was reported to have high sodium (330 mg/L) compared to the other samples collected across the monitoring program (<0.1 to 4.9 mg/L); chloride was not similarly elevated (which would support the sodium coming from sea salt). The reason for the high sodium result is unknown; the data was considered invalid and was not used in the total cation calculation.

The ion concentrations are provided in Table 3.14 and Table 3.15 along with the deposition per square metre (area of gauge mouth 0.066 m^2).

The non-sea salt sulfate (NSS $SO_2^{(2-)}$) was derived using the methodology provided by the World Data Centre for Precipitation Chemistry[6]. Where the analyte concentration was below the limit of reporting, the limit of reporting is reported and used in the calculation of the maximum total cation and anion sums. The minimum sum is calculated from the detect values only. The true total is somewhere between the minimum and maximum deposition values in the tables.

Mass concentration data is tabulated in Appendix F.

[5] Karratha Western Australia February 2022 Daily Weather Observations http://www.bom.gov.au/climate/dwo/202202/html/IDCJDW6064.202202.shtml

[6] The NSS SO_4 was derived using the following equation [NSS SO_4] = [SO_4] - (2.09 x [Mg]) which assumes that the reported magnesium has a marine source. This assumption was consistent with CSIROs prior approach; however, the exact method employed by CSIRO was not detailed (CSIRO 2010).

Table 3.14: Rainfall cations

Start date	End date	Volume	Rainfall	$NH_4^{(+1)}$	$Ca^{(+2)}$	$Mg^{(+2)}$	$H^{(+1)}$	$K^{(+1)}$	$Na^{(+1)}$	Min Σ cations	Max Σ cations	Min Σ cations	Max Σ cations
		mL	mm	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/m^2	mEq/m^2
KBSF Quarry													
29/09/2021	11/02/2022	1000	15	0.002	0.17	0.041	0.0008	0.013	0.213	0.444	0.444	6.7	6.7
20/04/2022	19/05/2022	9000	136	0.005	0.01	0.0082	0.0016	0.005	-	0.033	0.033	4.5	4.5
19/05/2022	15/06/2022	8000	121	0.012	0.02	0.016	0.0004	0.005	0.052	0.106	0.106	12.8	12.8
Visitor Centre													
29/09/2021	11/02/2022	1200	18	0.010	0.02	0.008	0.0016	<0.003	0.070	0.113	0.115	2.0	2.1
20/04/2022	19/05/2022	9000	136	0.004	0.01	0.016	0.0032	<0.003	0.083	0.118	0.121	16.1	16.5
19/05/2022	15/06/2022	9000	136	0.004	0.005	0.0082	0.0020	<0.003	0.043	0.060	0.063	8.2	8.6
AAQ Station													
29/09/2021	11/02/2022	1800	27	0.027	0.02	0.0165	0.0020	0.003	0.057	0.123	0.123	3.3	3.3
20/04/2022	19/05/2022	9000	136	0.003	<0.0050	0.0082	0.0040	<0.003	0.026	0.037	0.045	5.1	6.1
19/05/2022	15/06/2022	8000	121	0.004	<0.0050	0.0082	0.0040	<0.003	0.039	0.052	0.059	6.3	7.2
Mt Wongama													
29/09/2021	13/02/2022	260	4	0.004	0.08	0.033	0.0013	0.008	0.165	0.289	0.289	1.1	1.1
20/04/2022	19/05/2022	9000	136	0.004	0.01	0.033	0.0025	0.008	0.126	0.185	0.185	25.2	25.2
19/05/2022	15/06/2022	9000	136	0.002	0.01	0.033	0.0016	0.005	0.113	0.168	0.168	22.9	22.9
RT Pastoral Lease													
29/09/2021	23/02/2022	3000	45	0.011	0.03	0.033	0.0000	0.015	0.191	0.286	0.286	13.0	13.0
20/04/2022	15/06/2022	18000[$]	272	0.004	<0.0050	<0.008	0.0025	0.005	0.026	0.035	0.048	9.5	13.1

[$] Bucket overflowed due to no access to collect after first rainfall event; volume estimated as 18,000 mL which is the maximum sum of recorded volumes for last 2 rainfall events at the other monitoring sites

Table 3.15: Rainfall anions

Start date	End date	Volume	Rainfall	$Cl^{(-1)}$	$PO_4^{(-3)}$	$NO_3^{(-1)}$	$NO_2^{(-1)}$	$SO_4^{(-2)}$	NSS $SO_2^{(-2)}$	$HCO_3^{(-1)}$	$CH_3COO^{(-1)}$	$HCOO^{(-1)}$	Min Σ anions	Max Σ anions	Min Σ anions	Max Σ anions
		mL	mm	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/L	mEq/m^2	mEq/m
KBSF Quarry																
29/09/2021	11/02/2022	1000	15	0.175	<0.0003	0.021	<0.001	0.058	0.037	0.12	0.102	0.044	0.50	0.50	7.53	7.55
20/04/2022	19/05/2022	9000	136	0.155	<0.0003	0.009	<0.001	0.029	0.020	<0.049	<0.017	<0.022	0.21	0.27	29.07	37.31
19/05/2022	15/06/2022	8000	121	<0.14	<0.0003	<0.0007	<0.001	<0.021	<0.017	<0.049	0.254	<0.022	0.25	0.49	30.77	58.75
Visitor Centre																
29/09/2021	11/02/2022	1200	18	<0.14	<0.0003	0.0150	<0.001	<0.021	<0.017	<0.049	0.085	0.044	0.14	0.35	2.62	6.40
20/04/2022	19/05/2022	9000	136	<0.14	<0.0003	0.0014	<0.001	<0.021	<0.012	<0.049	<0.017	<0.022	0.00	0.24	0.19	33.30
19/05/2022	15/06/2022	9000	136	<0.14	<0.0003	<0.0007	<0.001	<0.021	<0.017	<0.049	0.254	<0.022	0.25	0.49	34.62	66.09
AAQ Station																
29/09/2021	11/02/2022	1800	27	<0.14	<0.0003	0.016	<0.001	<0.021	<0.012	<0.049	0.102	0.044	0.16	0.37	4.41	9.96
20/04/2022	19/05/2022	9000	136	<0.14	<0.0003	<0.0007	<0.001	<0.021	<0.017	<0.049	<0.017	<0.022	0.00	0.25	0.00	33.79
19/05/2022	15/06/2022	8000	121	<0.14	<0.0003	<0.001	<0.001	<0.021	<0.017	<0.049	0.237	<0.022	0.24	0.47	28.72	56.70
Mt Wongama																
29/09/2021	13/02/2022	260	3	<0.14	<0.0003	0.0286	<0.001	0.037	0.006	0.05	0.068	0.044	0.24	0.34	0.93	1.34
20/04/2022	19/05/2022	9000	136	<0.14	<0.0003	0.0043	<0.001	0.027	0.012	<0.049	<0.017	<0.022	0.04	0.25	5.95	33.69
19/05/2022	15/06/2022	9000	136	<0.14	<0.0003	0.0007	<0.001	0.033	0.012	<0.049	0.254	<0.022	0.30	0.48	40.93	65.52
RT Pastoral Lease																
29/09/2021	23/02/2022	3000	45	0.2	<0.0003	0.0164	0.0014	0.023	0.006	0.07	0.102	0.044	0.27	0.44	12.08	20.15
20/04/2022	15/06/2022	18000	272	<0.14	<0.0003	0.0021	<0.001	<0.021	<0.017	<0.049	0.305	<0.022	0.31	0.54	83.66	146.43

Limitations

Scope of services

This report ("the report") has been prepared by Strategen-JBS&G in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen-JBS&G. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

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The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

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4. References

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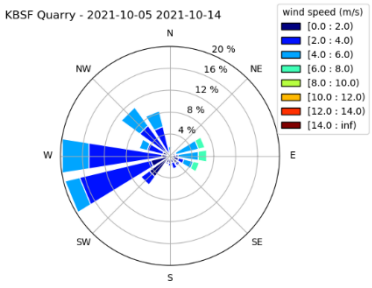
Appendix A Wind roses (Radiello sampling periods)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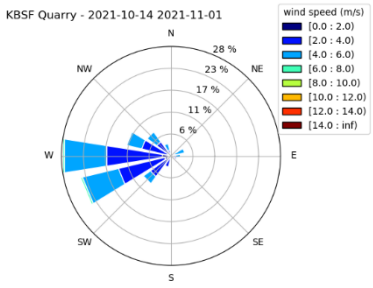
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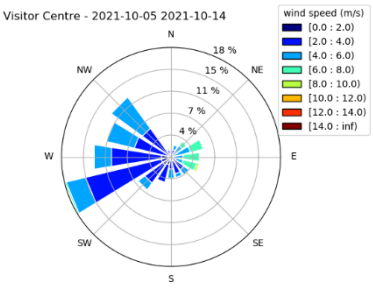
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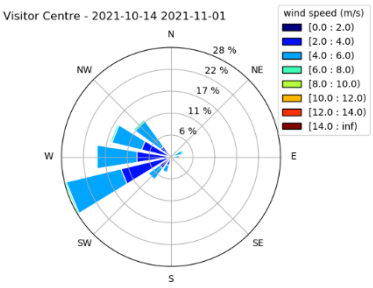
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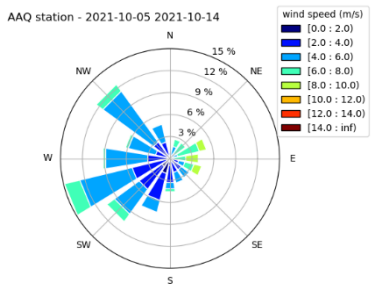
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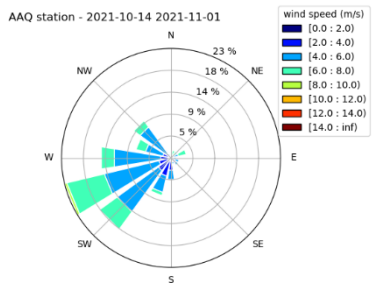
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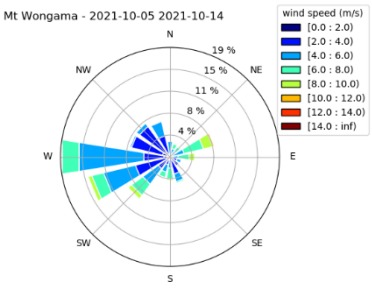
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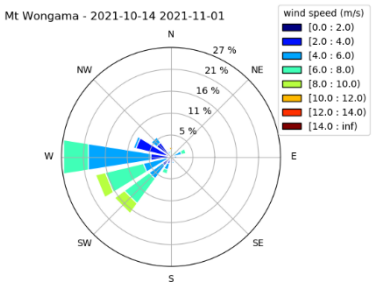
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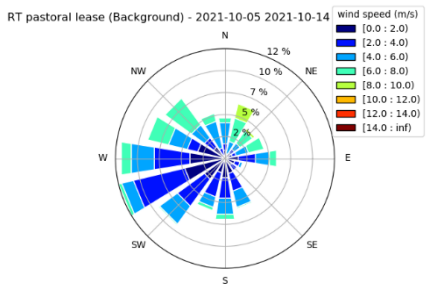
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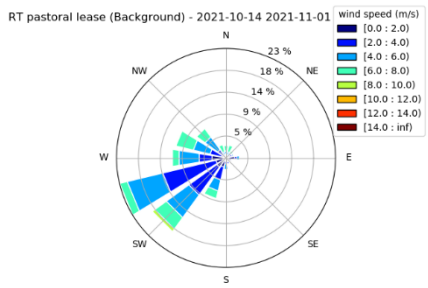
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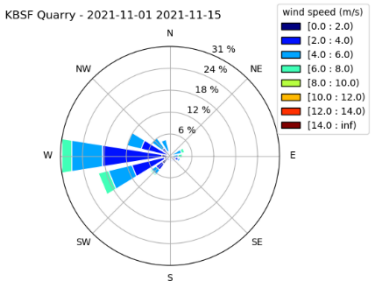
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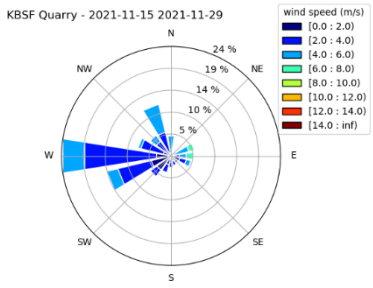
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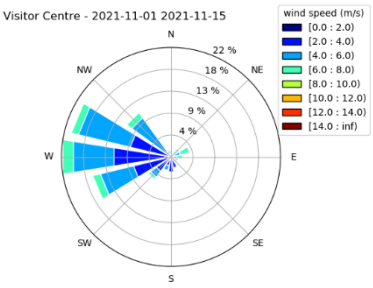
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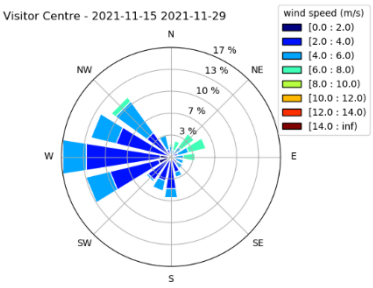
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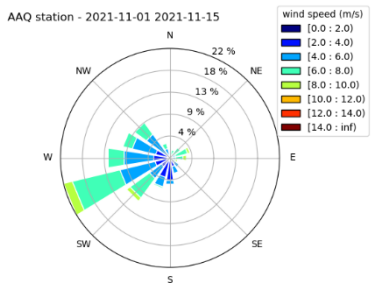
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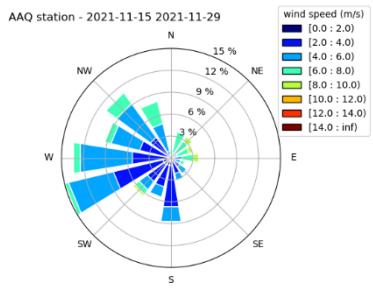
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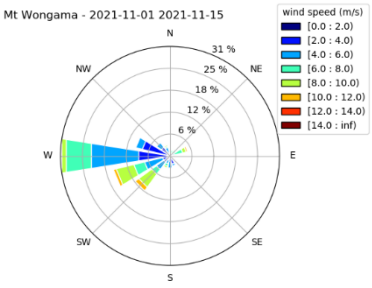
Mt Wongama - 2021-11-01 2021-11-15
wind speed (m/s)
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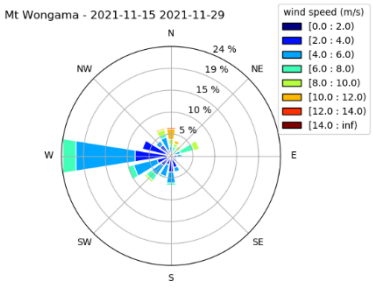
Mt Wongama - 2021-11-15 2021-11-29
wind speed (m/s)
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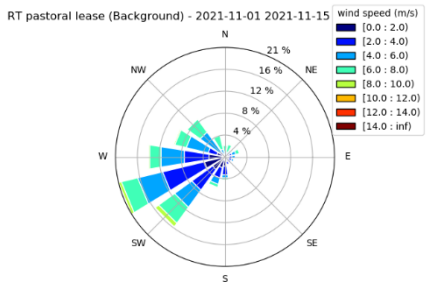
RT pastoral lease (Background) - 2021-11-01 2021-11-15
wind speed (m/s)
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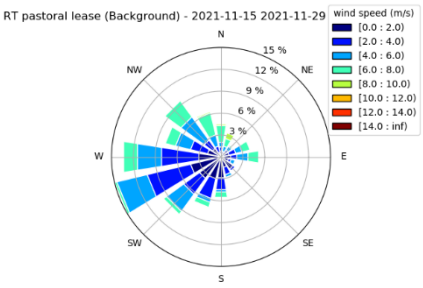
RT pastoral lease (Background) - 2021-11-15 2021-11-29
wind speed (m/s)
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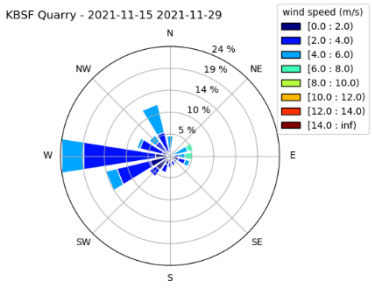
KBSF Quarry - 2021-11-15 2021-11-29
wind speed (m/s)
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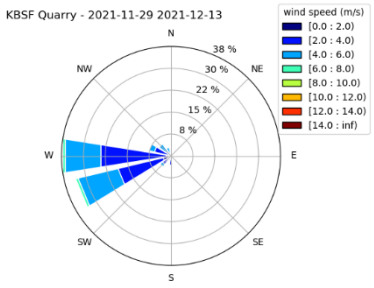
KBSF Quarry - 2021-11-29 2021-12-13
wind speed (m/s)
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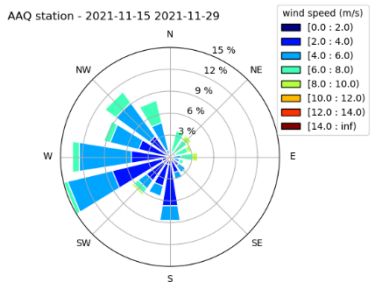
AAQ station - 2021-11-15 2021-11-29
wind speed (m/s)
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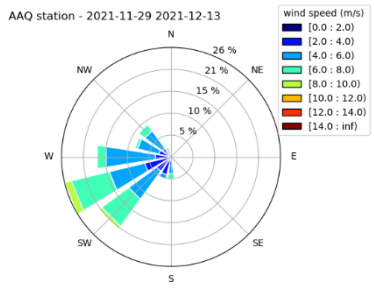
AAQ station - 2021-11-29 2021-12-13
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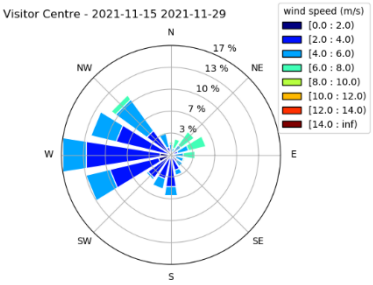
Visitor Centre - 2021-11-15 2021-11-29
wind speed (m/s)
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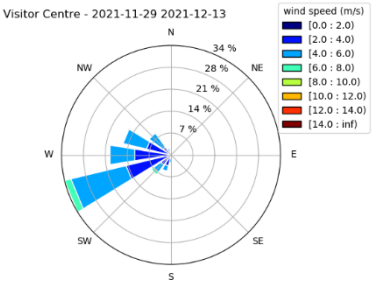
Visitor Centre - 2021-11-29 2021-12-13
wind speed (m/s)
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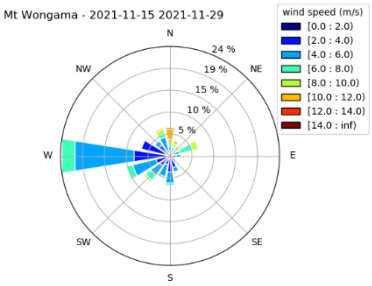
Mt Wongama - 2021-11-15 2021-11-29
wind speed (m/s)
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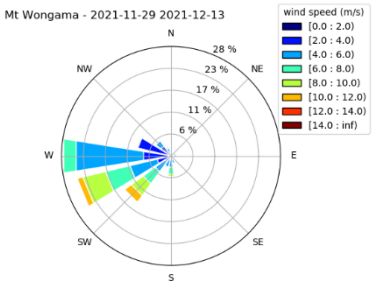
Mt Wongama - 2021-11-29 2021-12-13
wind speed (m/s)
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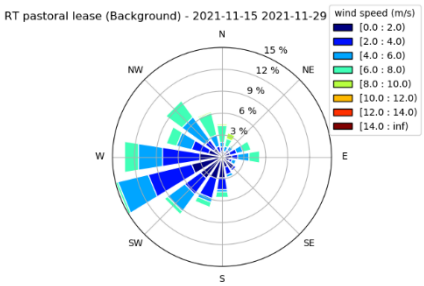
RT pastoral lease (Background) - 2021-11-15 2021-11-29
wind speed (m/s)
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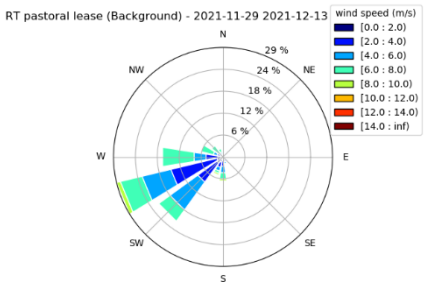
RT pastoral lease (Background) - 2021-11-29 2021-12-13
wind speed (m/s)
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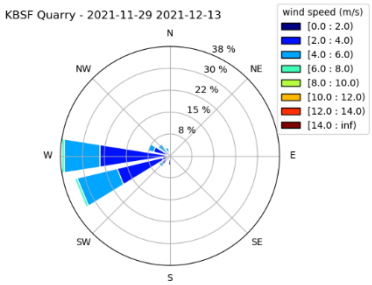
KBSF Quarry - 2021-11-29 2021-12-13
wind speed (m/s)
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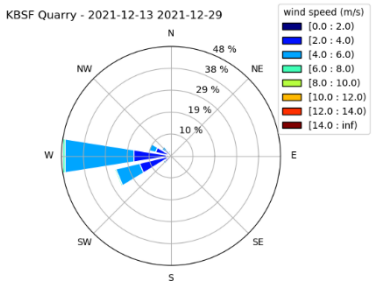
KBSF Quarry - 2021-12-13 2021-12-29
wind speed (m/s)
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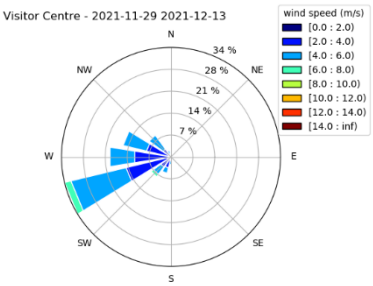
Visitor Centre - 2021-11-29 2021-12-13
wind speed (m/s)
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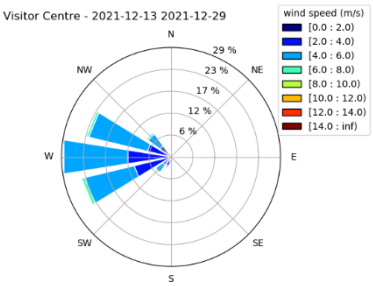
Visitor Centre - 2021-12-13 2021-12-29
wind speed (m/s)
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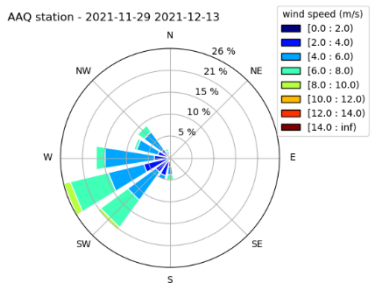
AAQ station - 2021-11-29 2021-12-13
wind speed (m/s)
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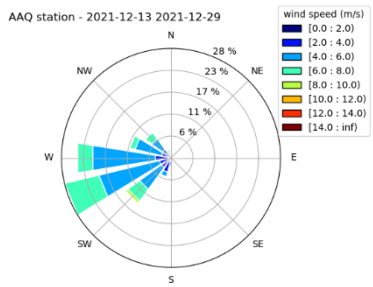
AAQ station - 2021-12-13 2021-12-29
wind speed (m/s)
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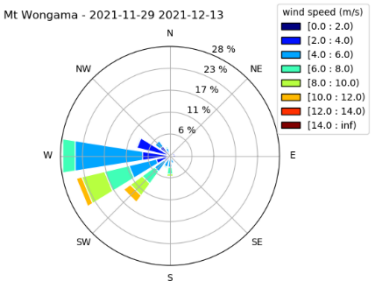
Mt Wongama - 2021-11-29 2021-12-13
wind speed (m/s)
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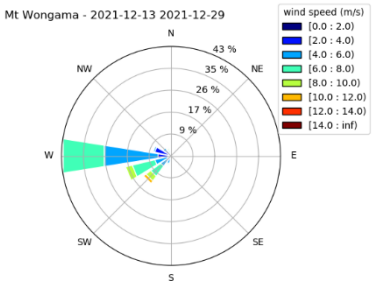
Mt Wongama - 2021-12-13 2021-12-29
wind speed (m/s)
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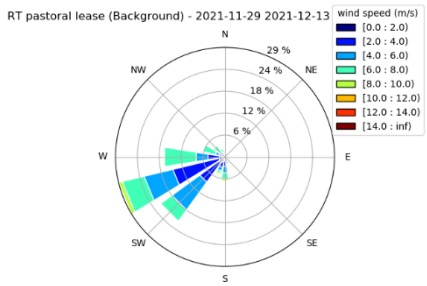
RT pastoral lease (Background) - 2021-11-29 2021-12-13
wind speed (m/s)
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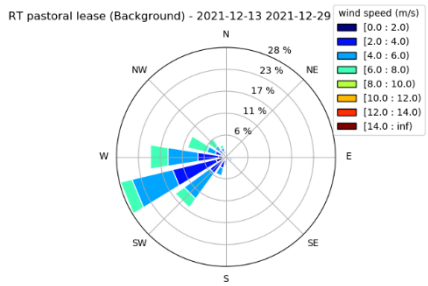
RT pastoral lease (Background) - 2021-12-13 2021-12-29
wind speed (m/s)
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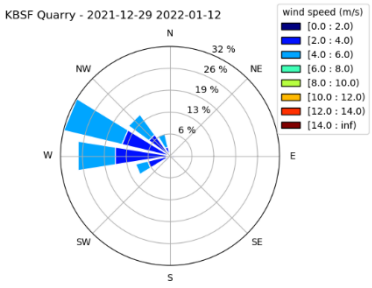
KBSF Quarry - 2021-12-29 2022-01-12
wind speed (m/s)
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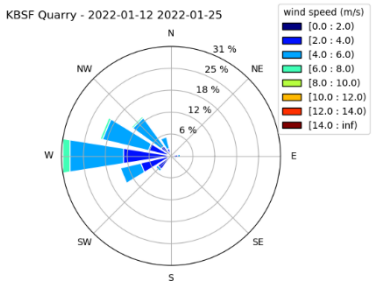
KBSF Quarry - 2022-01-12 2022-01-25
wind speed (m/s)
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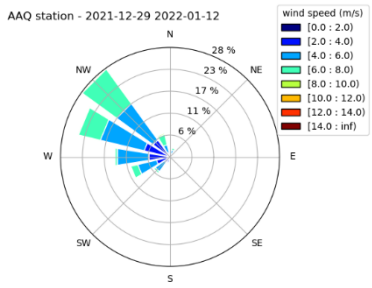
AAQ station - 2021-12-29 2022-01-12
wind speed (m/s)
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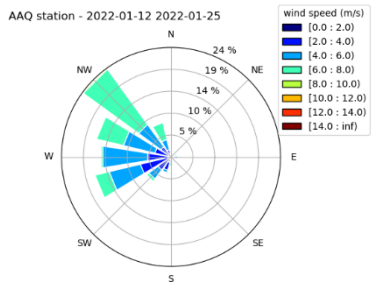
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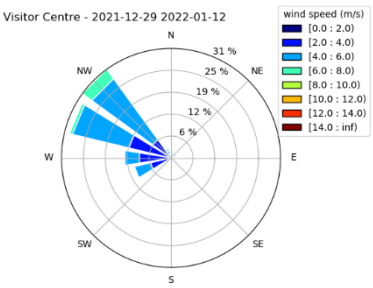
Visitor Centre - 2021-12-29 2022-01-12
wind speed (m/s)
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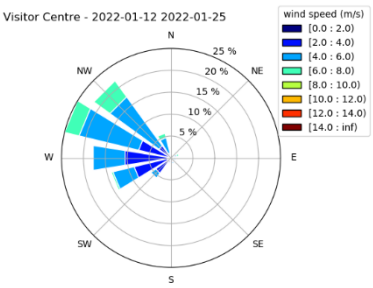
Visitor Centre - 2022-01-12 2022-01-25
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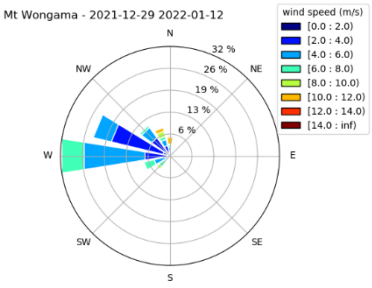
Mt Wongama - 2021-12-29 2022-01-12
wind speed (m/s)
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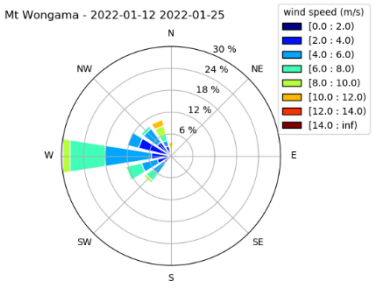
Mt Wongama - 2022-01-12 2022-01-25
wind speed (m/s)
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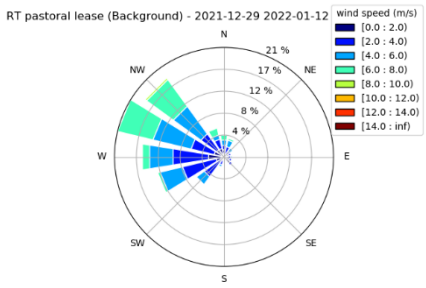
RT pastoral lease (Background) - 2021-12-29 2022-01-12
wind speed (m/s)
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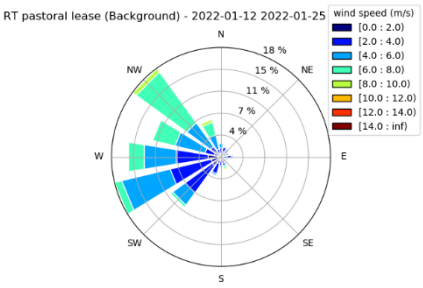
RT pastoral lease (Background) - 2022-01-12 2022-01-25
wind speed (m/s)
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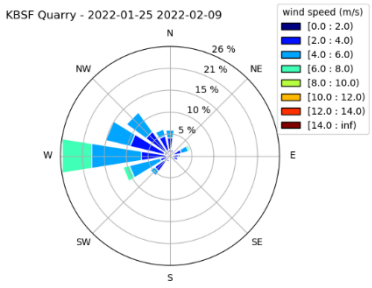
KBSF Quarry - 2022-01-25 2022-02-09
wind speed (m/s)
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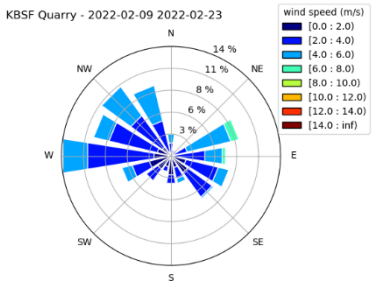
KBSF Quarry - 2022-02-09 2022-02-23
wind speed (m/s)
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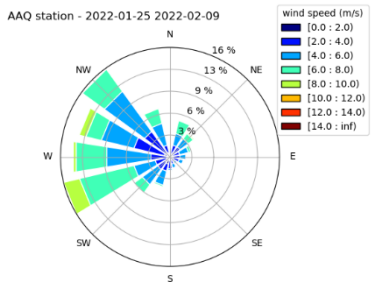
AAQ station - 2022-01-25 2022-02-09
wind speed (m/s)
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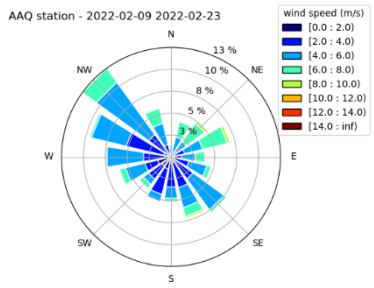
AAQ station - 2022-02-09 2022-02-23
wind speed (m/s)
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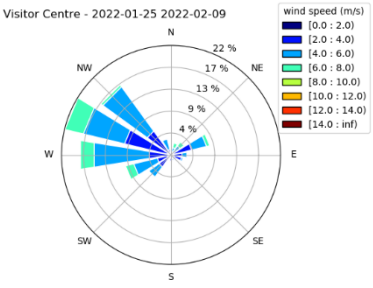
Visitor Centre - 2022-01-25 2022-02-09
wind speed (m/s)
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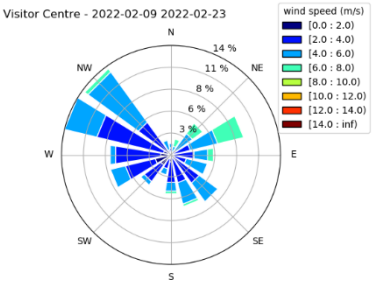
Visitor Centre - 2022-02-09 2022-02-23
wind speed (m/s)
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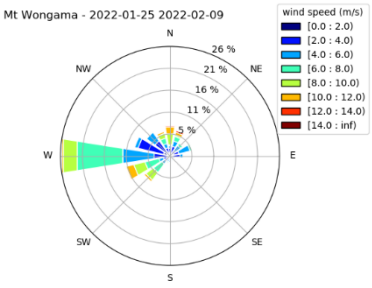
Mt Wongama - 2022-01-25 2022-02-09
wind speed (m/s)
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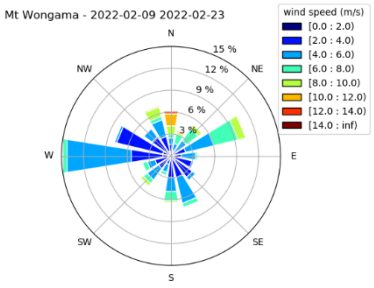
Mt Wongama - 2022-02-09 2022-02-23
wind speed (m/s)
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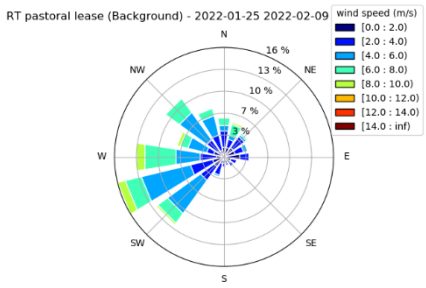
RT pastoral lease (Background) - 2022-01-25 2022-02-09
wind speed (m/s)
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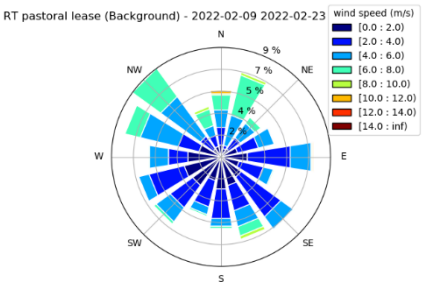
RT pastoral lease (Background) - 2022-02-09 2022-02-23
wind speed (m/s)
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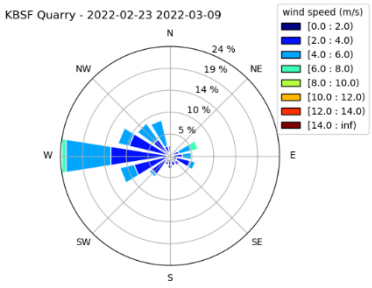
KBSF Quarry - 2022-02-23 2022-03-09
wind speed (m/s)
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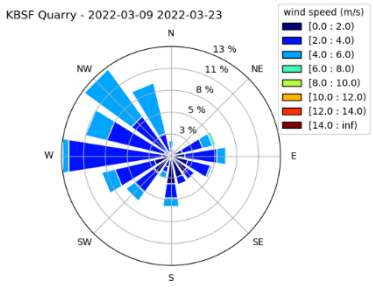
KBSF Quarry - 2022-03-09 2022-03-23
wind speed (m/s)
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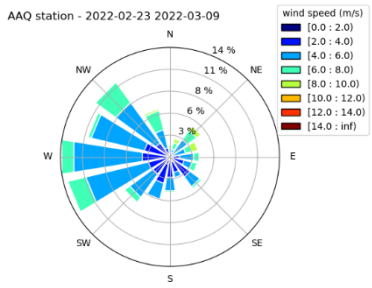
AAQ station - 2022-02-23 2022-03-09
wind speed (m/s)
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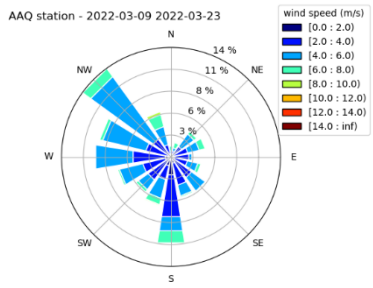
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wind speed (m/s)
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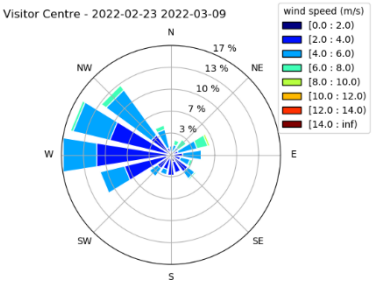
Visitor Centre - 2022-02-23 2022-03-09
wind speed (m/s)
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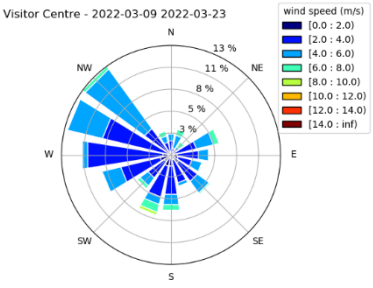
Visitor Centre - 2022-03-09 2022-03-23
wind speed (m/s)
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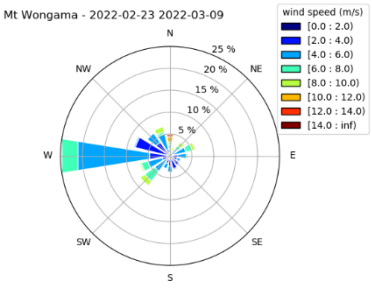
Mt Wongama - 2022-02-23 2022-03-09
wind speed (m/s)
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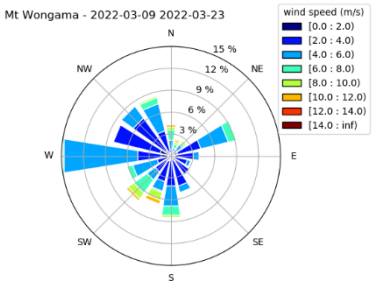
Mt Wongama - 2022-03-09 2022-03-23
wind speed (m/s)
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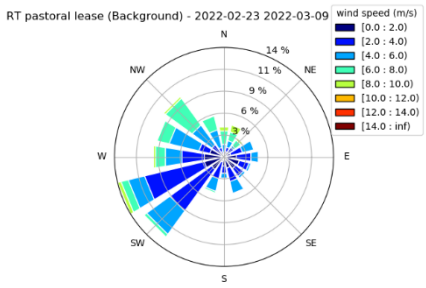
RT pastoral lease (Background) - 2022-02-23 2022-03-09
wind speed (m/s)
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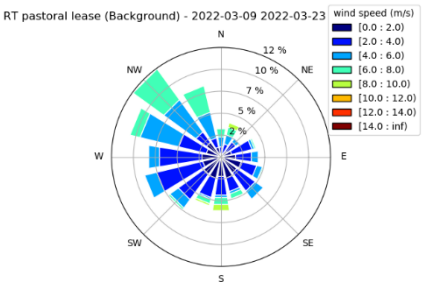
RT pastoral lease (Background) - 2022-03-09 2022-03-23
wind speed (m/s)
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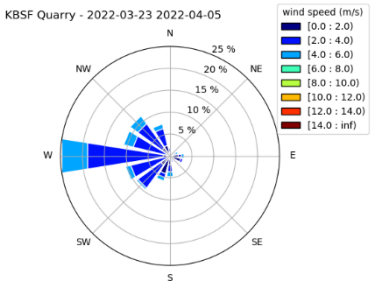
KBSF Quarry - 2022-03-23 2022-04-05
wind speed (m/s)
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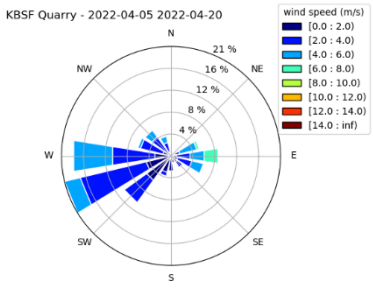
KBSF Quarry - 2022-04-05 2022-04-20
wind speed (m/s)
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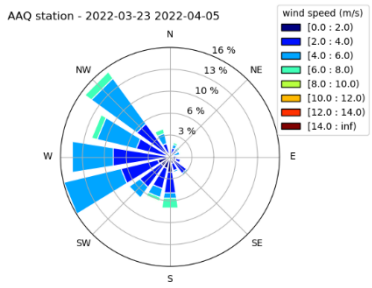
AAQ station - 2022-03-23 2022-04-05
wind speed (m/s)
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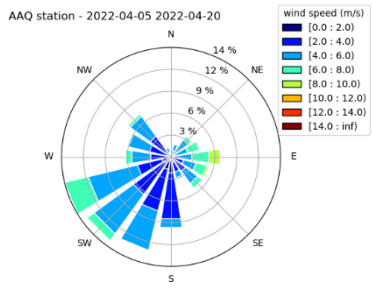
AAQ station - 2022-04-05 2022-04-20
wind speed (m/s)
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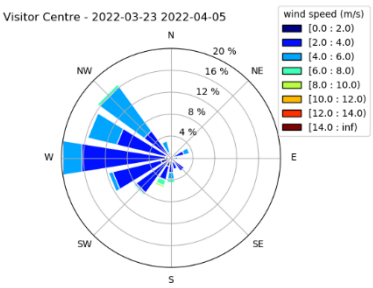
Visitor Centre - 2022-03-23 2022-04-05
wind speed (m/s)
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[2.0 : 4.0)
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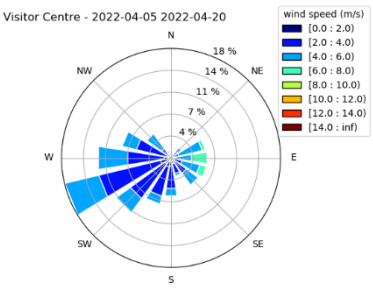
Visitor Centre - 2022-04-05 2022-04-20
wind speed (m/s)
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[2.0 : 4.0)
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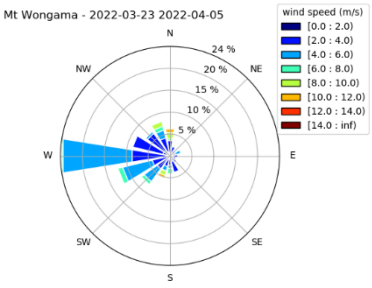
Mt Wongama - 2022-03-23 2022-04-05
wind speed (m/s)
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[2.0 : 4.0)
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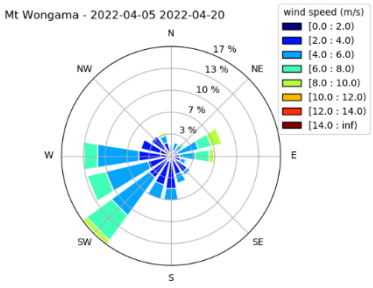
Mt Wongama - 2022-04-05 2022-04-20
wind speed (m/s)
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[2.0 : 4.0)
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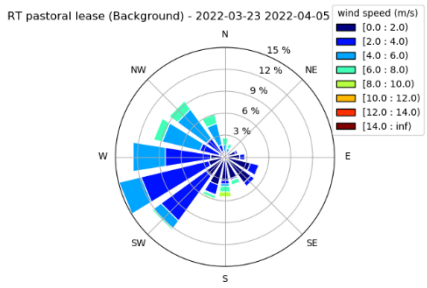
RT pastoral lease (Background) - 2022-03-23 2022-04-05
wind speed (m/s)
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[4.0 : 6.0)
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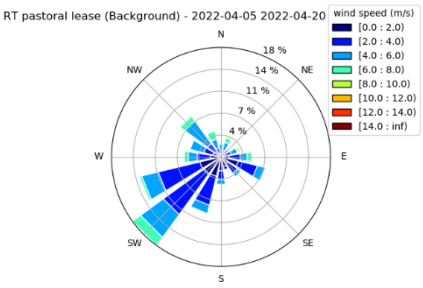
RT pastoral lease (Background) - 2022-04-05 2022-04-20
wind speed (m/s)
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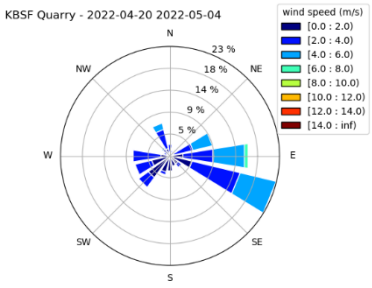
KBSF Quarry - 2022-04-20 2022-05-04
wind speed (m/s)
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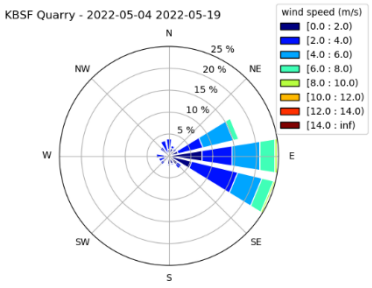
KBSF Quarry - 2022-05-04 2022-05-19
wind speed (m/s)
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[4.0 : 6.0)
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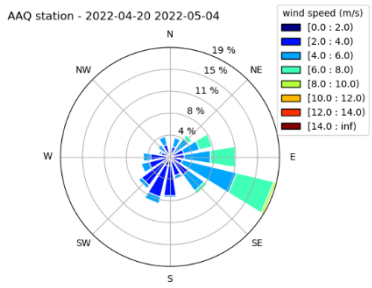
AAQ station - 2022-04-20 2022-05-04
wind speed (m/s)
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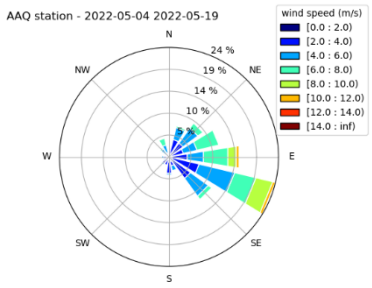
AAQ station - 2022-05-04 2022-05-19
wind speed (m/s)
[0.0 : 2.0)
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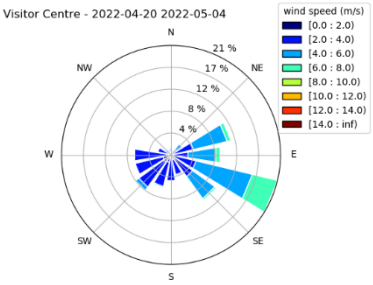
Visitor Centre - 2022-04-20 2022-05-04
wind speed (m/s)
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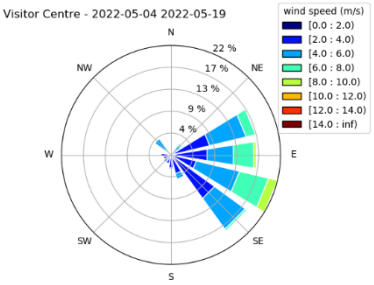
Visitor Centre - 2022-05-04 2022-05-19
wind speed (m/s)
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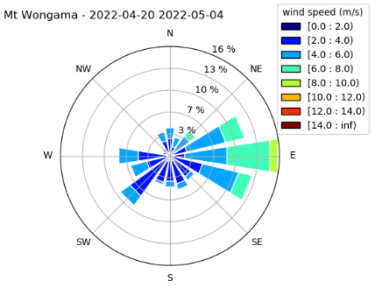
Mt Wongama - 2022-04-20 2022-05-04
wind speed (m/s)
[0.0 : 2.0)
[2.0 : 4.0)
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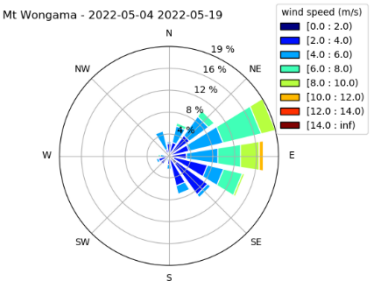
Mt Wongama - 2022-05-04 2022-05-19
wind speed (m/s)
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[2.0 : 4.0)
[4.0 : 6.0)
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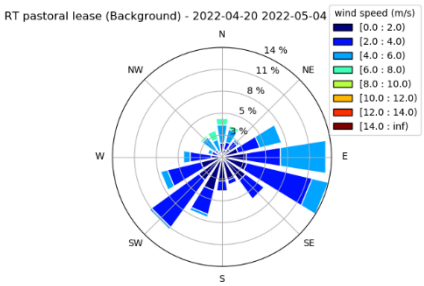
RT pastoral lease (Background) - 2022-04-20 2022-05-04
wind speed (m/s)
[0.0 : 2.0)
[2.0 : 4.0)
[4.0 : 6.0)
[6.0 : 8.0)
[8.0 : 10.0)
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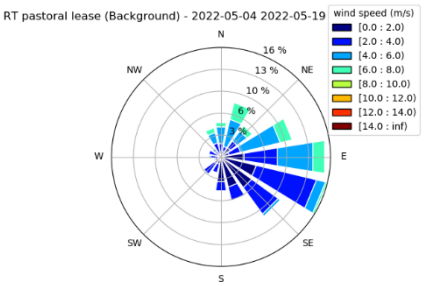
RT pastoral lease (Background) - 2022-05-04 2022-05-19
wind speed (m/s)
[0.0 : 2.0)
[2.0 : 4.0)
[4.0 : 6.0)
[6.0 : 8.0)
[8.0 : 10.0)
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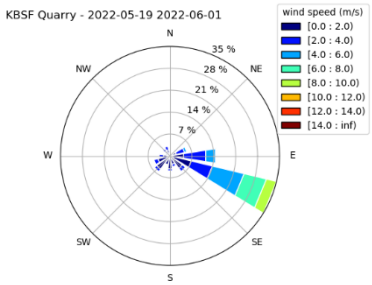
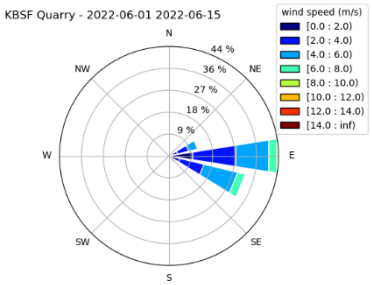
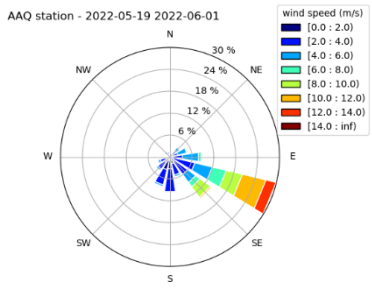
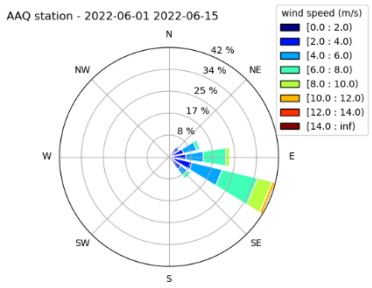
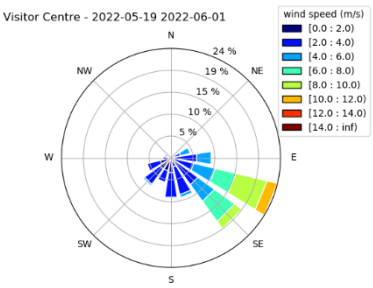
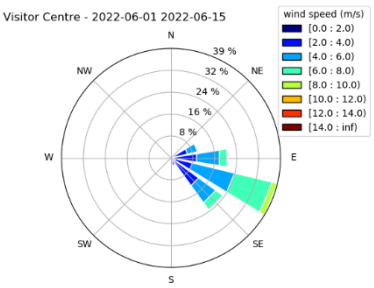


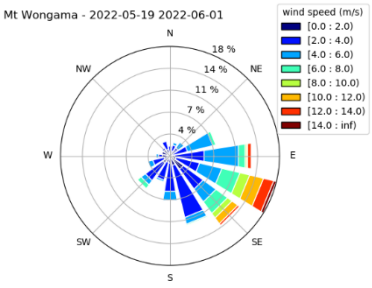


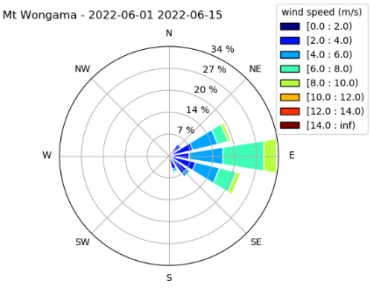






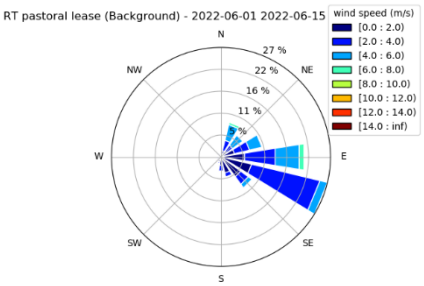


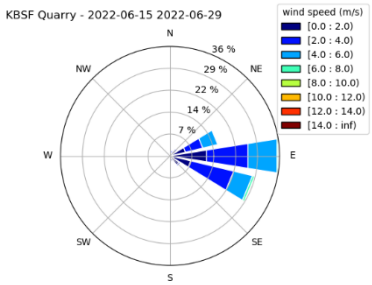




RT Pastoral lease wind sensor malfunction

18 May 2022 to 1 June 2022




KBSF Quarry - 2022-06-15 2022-06-29
wind speed (m/s)
[0.0 : 2.0)
[2.0 : 4.0)
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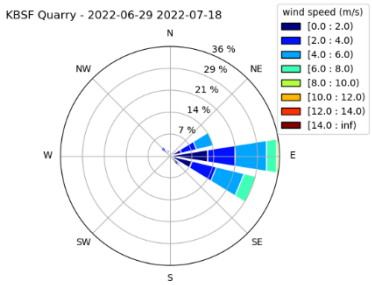
KBSF Quarry - 2022-06-29 2022-07-18
wind speed (m/s)
[0.0 : 2.0)
[2.0 : 4.0)
[4.0 : 6.0)
[6.0 : 8.0)
[8.0 : 10.0)
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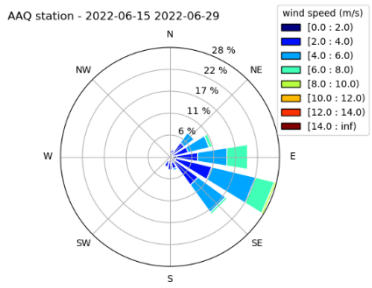
AAQ station - 2022-06-15 2022-06-29
wind speed (m/s)
[0.0 : 2.0)
[2.0 : 4.0)
[4.0 : 6.0)
[6.0 : 8.0)
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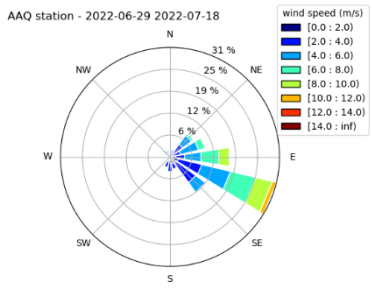
AAQ station - 2022-06-29 2022-07-18
wind speed (m/s)
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[2.0 : 4.0)
[4.0 : 6.0)
[6.0 : 8.0)
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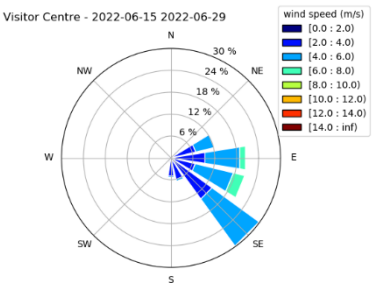
Visitor Centre - 2022-06-15 2022-06-29
wind speed (m/s)
[0.0 : 2.0)
[2.0 : 4.0)
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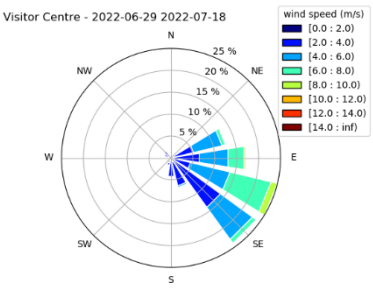
Visitor Centre - 2022-06-29 2022-07-18
wind speed (m/s)
[0.0 : 2.0)
[2.0 : 4.0)
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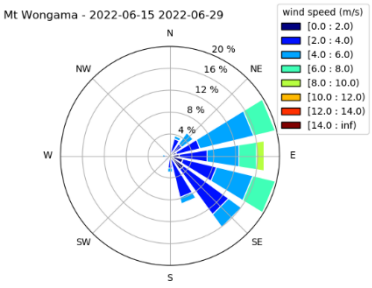
Mt Wongama - 2022-06-15 2022-06-29
wind speed (m/s)
[0.0 : 2.0)
[2.0 : 4.0)
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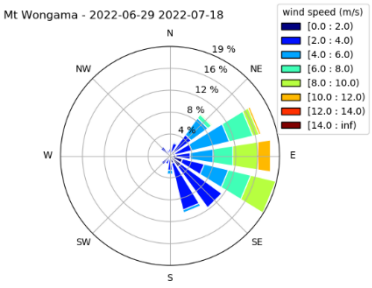
Mt Wongama - 2022-06-29 2022-07-18
wind speed (m/s)
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[2.0 : 4.0)
[4.0 : 6.0)
[6.0 : 8.0)
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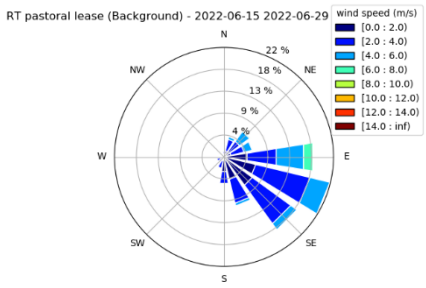
RT pastoral lease (Background) - 2022-06-15 2022-06-29
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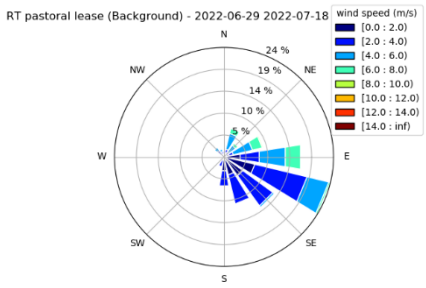
RT pastoral lease (Background) - 2022-06-29 2022-07-18
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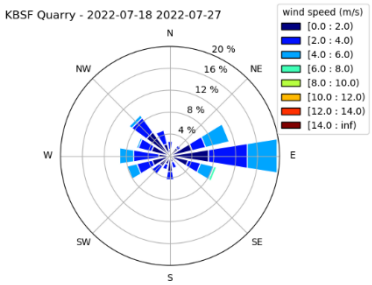
KBSF Quarry - 2022-07-18 2022-07-27
wind speed (m/s)
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[8.0 : 10.0)
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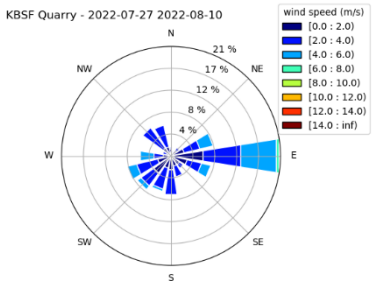
KBSF Quarry - 2022-07-27 2022-08-10
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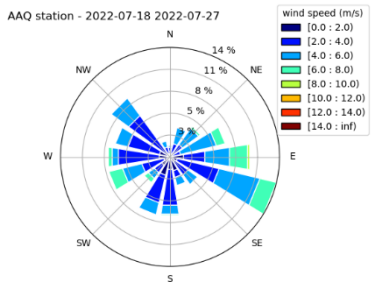
AAQ station - 2022-07-18 2022-07-27
wind speed (m/s)
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[2.0 : 4.0)
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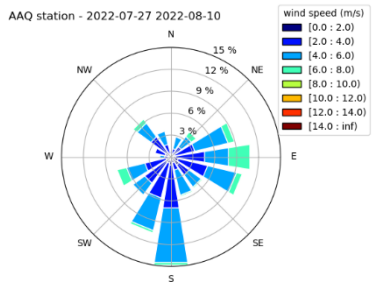
AAQ station - 2022-07-27 2022-08-10
wind speed (m/s)
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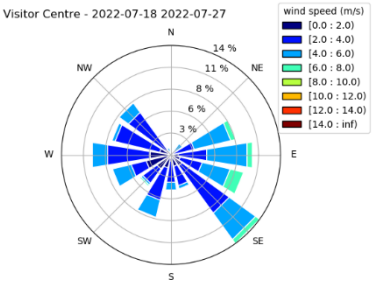
Visitor Centre - 2022-07-18 2022-07-27
wind speed (m/s)
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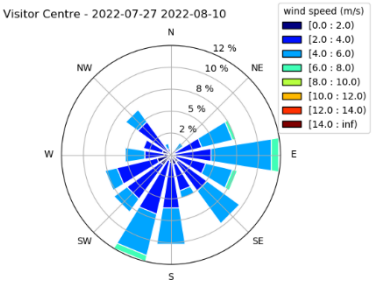
Visitor Centre - 2022-07-27 2022-08-10
wind speed (m/s)
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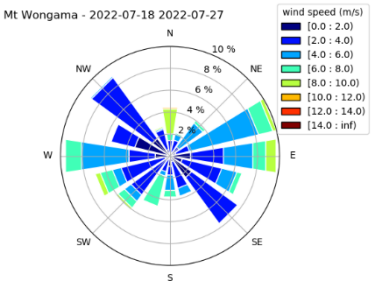
Mt Wongama - 2022-07-18 2022-07-27
wind speed (m/s)
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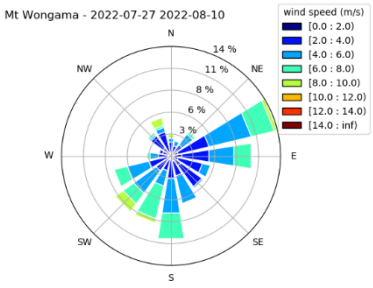
Mt Wongama - 2022-07-27 2022-08-10
wind speed (m/s)
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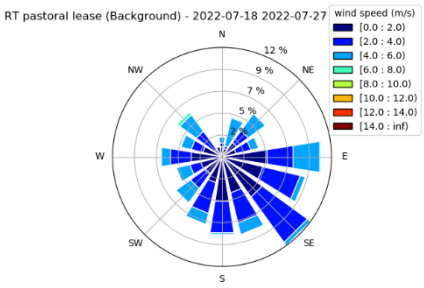
RT pastoral lease (Background) - 2022-07-18 2022-07-27
wind speed (m/s)
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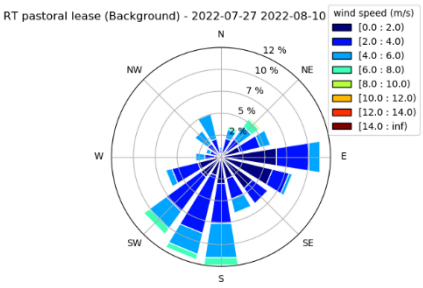
RT pastoral lease (Background) - 2022-07-27 2022-08-10
wind speed (m/s)
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[4.0 : 6.0)
[6.0 : 8.0)
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[10.0 : 12.0)
[12.0 : 14.0)
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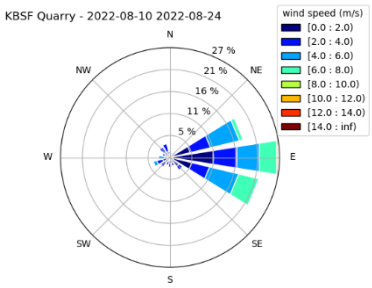
KBSF Quarry - 2022-08-10 2022-08-24
wind speed (m/s)
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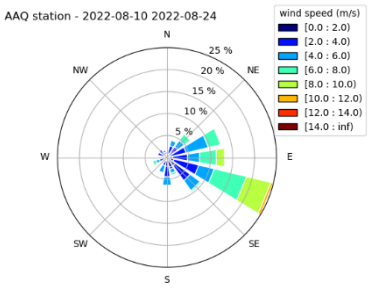
AAQ station - 2022-08-10 2022-08-24
wind speed (m/s)
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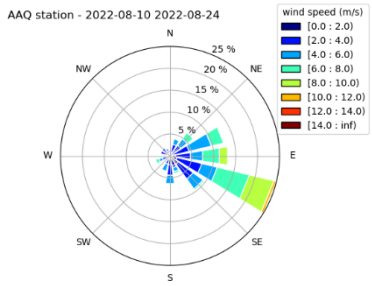
AAQ station - 2022-08-10 2022-08-24
wind speed (m/s)
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[2.0 : 4.0)
[4.0 : 6.0)
[6.0 : 8.0)
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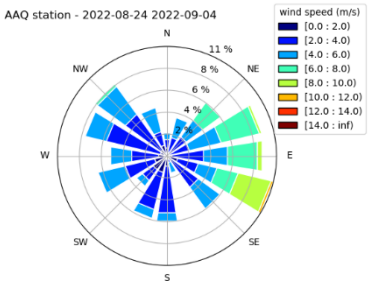
AAQ station - 2022-08-24 2022-09-04
wind speed (m/s)
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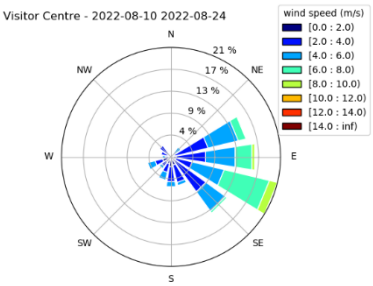
Visitor Centre - 2022-08-10 2022-08-24
wind speed (m/s)
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[2.0 : 4.0)
[4.0 : 6.0)
[6.0 : 8.0)
[8.0 : 10.0)
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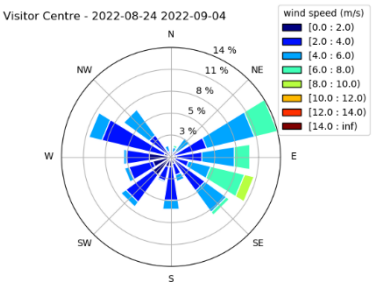
Visitor Centre - 2022-08-24 2022-09-04
wind speed (m/s)
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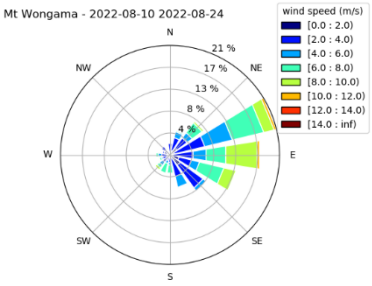
Mt Wongama - 2022-08-10 2022-08-24
wind speed (m/s)
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[2.0 : 4.0)
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[6.0 : 8.0)
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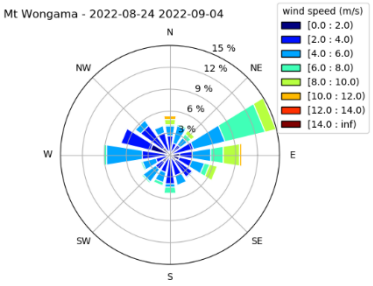
Mt Wongama - 2022-08-24 2022-09-04
wind speed (m/s)
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[2.0 : 4.0)
[4.0 : 6.0)
[6.0 : 8.0)
[8.0 : 10.0)
[10.0 : 12.0)
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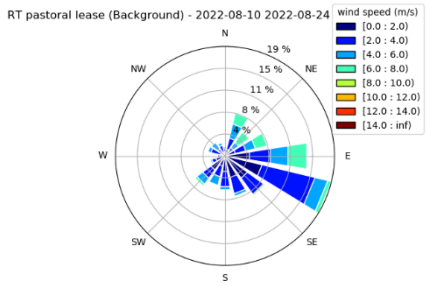
RT pastoral lease (Background) - 2022-08-10 2022-08-24
wind speed (m/s)
[0.0 : 2.0)
[2.0 : 4.0)
[4.0 : 6.0)
[6.0 : 8.0)
[8.0 : 10.0)
[10.0 : 12.0)
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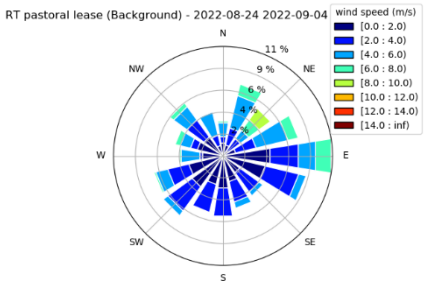
RT pastoral lease (Background) - 2022-08-24 2022-09-04
wind speed (m/s)
[0.0 : 2.0)
[2.0 : 4.0)
[4.0 : 6.0)
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Appendix B Gaseous data Radiello samplers

NO_2 µg/m³ nominal 15 day average										
Sampling dates	**KBSF Quarry**	**KBSF Quarry - Dup**	**Mt Wongama**	**Mt Wongama - Dup**	**Visitor Centre**	**Visitor Centre - Dup**	**RT Pastoral Lease**	**RT Pastoral Lease - Dup**	**AAQ Station**	**AAQ Station - Dup**
29 Sep 21 - 14 Oct 21	7.02	5.81	4.42	4.47	5.80	#N/A	#N/A	1.14	5.74	5.74
14 Oct 21 - 1 Nov 21	5.34	4.83	4.38	3.97	#N/A	4.74	#N/A	#N/A	#N/A	#N/A
1 Nov 21 - 15 Nov 21	5.04	6.45	0.03	2.40	3.68	3.75	0.81	0.94	3.91	3.78
15 Nov 21 - 29 Nov 21	#N/A	7.69	3.22	#N/A	#N/A	6.63	1.24	1.24	#N/A	#N/A
29 Nov 21 - 13 Dec 21	5.63	5.28	6.68	7.24	4.58	#N/A	0.03	1.15	4.65	5.47
13 Dec 21 - 29 Dec 21	5.57	5.06	#N/A	#N/A	4.37	4.05	2.11	1.72	4.38	4.33
29 Dec 21 - 12 Jan 22	#N/A	#N/A	1.60	#N/A	2.32	#N/A	1.11	#N/A	2.20	1.77
12 Jan 22 - 25 Jan 22	3.84	#N/A	2.05	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
25 Jan 22 - 9 Feb 22	#N/A	#N/A	1.72	1.54	2.58	2.64			1.72	1.66
9 Feb 22 - 23 Feb 22	#N/A	3.85	1.89	0.03	4.01	4.33	1.48	1.34	3.96	2.85
23 Feb 22 - 9 Mar 22	2.73	2.67	2.55	2.55	3.39	#N/A	1.12	2.02	3.26	#N/A
9 Mar 22-23 Mar 22	3.41	#N/A	1.93	0.03	4.57	4.63	1.47	1.52	3.18	2.79
23 March 22 -5 April 22	3.08	3.34	1.56	4.30	2.40	2.53	1.52	#N/A	2.71	2.52
5 April 22 - 20 April 22	5.22	5.22	6.14	3.85	5.68	5.68	1.19	1.25	5.18	5.72
20 April 22 - 4 May 22	5.42	5.36	2.91	3.41	5.18	#N/A	1.99	#N/A	4.55	5.20
4 May 22 - 19 May 22	2.60	3.89	0.82	1.20	2.17	1.26	1.27	0.62	1.85	1.66
19 May 22 - 1 June 22	4.80	4.26	1.04	#N/A	0.60	2.38			1.75	2.52
1 June 22 - 15 June 22	6.14	3.03	0.93	0.86	2.15	1.79			1.75	2.03
15 June 22 - 29 June 22	6.74	8.80	1.50	1.64	2.98	1.52	1.55	1.48	3.18	3.45
29 June 22 - 18 July 22	5.86	6.40	1.57	1.24	1.78	2.06	1.13	1.24	2.60	2.38
18 July 2022 - 27 July 22	12.66	13.82	3.72	4.61	8.38	6.97	2.75	2.53	5.99	7.38
27 July 2022 - 10 Aug 22	6.40	6.82	3.26	3.11	5.58	#N/A	3.20	3.27	5.74	4.35
10 Aug 22 - 24 Aug 22	6.05	6.12	2.85	2.36	2.58	3.06	1.34	1.56	3.53	3.53
24 Aug 22 - 9 Sep 22	5.49	5.49	1.80	2.07	3.14	5.02	1.17	1.17	4.07	4.16

HNO_3 µg/m^3 Nominal 15 day average										
Sampling dates	KBSF Quarry	KBSF Quarry - Dup	Mt Wongama	Mt Wongama - Dup	Visitor Centre	Visitor Centre - Dup	RT Pastoral Lease	RT Pastoral Lease - Dup	AAQ Station	AAQ Station - Dup
29 Sep 21 - 14 Oct 21	0.08	0.04	0.17	0.25	0.08	#N/A	#N/A	0.08	0.08	0.08
14 Oct 21 - 1 Nov 21	0.35	0.07	0.14	0.43	#N/A	0.28	#N/A	#N/A	#N/A	#N/A
1 Nov 21 - 15 Nov 21	0.19	0.09	#N/A	0.09	0.04	0.04	0.05	0.09	0.05	0.05
15 Nov 21 - 29 Nov 21	#N/A	0.59	0.17	#N/A	#N/A	0.09	0.08	0.08	#N/A	#N/A
29 Nov 21 - 13 Dec 21	0.04	0.04	0.04	0.04	0.04	#N/A	0.04	0.04	0.04	0.04
13 Dec 21 - 29 Dec 21	0.04	0.36	#N/A	#N/A	0.73	0.73	1.84	0.27	0.43	#N/A
29 Dec 21 - 12 Jan 22	#N/A	#N/A	0.58	#N/A	5.79	#N/A	0.08	#N/A	1.19	0.25
12 Jan 22 - 25 Jan 22	0.54	#N/A	3.29	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
25 Jan 22 - 9 Feb 22	#N/A	#N/A	0.74	0.08	0.17	0.09			0.04	0.04
9 Feb 22 - 23 Feb 22	0.24	#N/A	0.32	2.55	1.23	0.49	0.04	0.85	2.16	1.04
23 Feb 22 - 9 Mar 22	0.32	0.24	1.42	0.63	0.73	#N/A	0.08	1.56	0.40	#N/A
9 Mar 22-23 Mar 22	0.23	#N/A	0.16	0.04	0.85	1.32	0.23	0.23	0.23	0.16
23 March 22 - 5 April 22	0.09	0.45	0.36	0.91	1.32	2.29	1.06	#N/A	4.03	0.35
5 April 22 - 20 April 22	0.23	0.23	0.52	0.59	0.04	0.08	0.04	0.04	0.15	0.08
20 April 22 - 4 May 22	2.19	0.18	0.09	0.26	0.26	#N/A	0.09	#N/A	0.81	0.72
4 May 22 - 19 May 22	0.52	0.95	5.98	2.82	0.17	0.53	0.12	0.25	2.74	0.43
19 May 22 - 1 June 22	2.01	0.32	1.04	#N/A	0.21	0.62			0.53	0.42
1 June 22 - 15 June 22	0.90	2.31	1.89	2.79	0.80	2.99			0.10	1.85
15 June 22 - 29 June 22	0.19	0.19	1.19	0.10	0.58	0.05	0.39	0.20	0.10	0.10
29 June 22 - 18 July 22	0.08	1.43	0.08	0.15	0.08	0.08	0.16	0.08	0.39	0.54
18 July 2022 - 27 July 22	0.08	0.80	0.46	0.62	0.16	1.63	0.16	0.16	0.08	0.08
27 July 2022 - 10 Aug 22	0.05	0.05	0.05	0.20	2.89	#N/A	0.10	0.05	1.55	0.77
10 Aug 22 - 24 Aug 22	1.00	0.20	0.19	0.58	0.10	0.29	0.59	0.39	0.19	0.19
24 Aug 22 - 9 Sep 22	0.06	0.06	0.06	0.12	0.06	0.06	0.06	0.06	0.50	0.76

SO_2 µg/m^3 Nominal 15 day average										
Sampling dates	**KBSF Quarry**	**KBSF Quarry - Dup**	**Mt Wongama**	**Mt Wongama - Dup**	**Visitor Centre**	**Visitor Centre - Dup**	**RT Pastoral Lease**	**RT Pastoral Lease - Dup**	**AAQ Station**	**AAQ Station - Dup**
29 Sep 21 - 14 Oct 21	0.05	0.03	0.13	0.15	0.15	#N/A	#N/A	0.03	0.13	0.10
14 Oct 21 - 1 Nov 21	0.15	0.07	0.20	0.13	#N/A	0.13	#N/A	#N/A	#N/A	#N/A
1 Nov 21 - 15 Nov 21	0.08	0.11	0.01	0.08	0.10	0.10	0.08	0.11	0.11	0.08
15 Nov 21 - 29 Nov 21	#N/A	0.18	0.07	#N/A	#N/A	0.07	0.01	0.01	#N/A	#N/A
29 Nov 21 - 13 Dec 21	0.01	0.01	0.01	0.01	#N/A	0.08	0.11	0.11	0.08	0.11
13 Dec 21 - 29 Dec 21	0.05	0.22	#N/A	#N/A	0.49	0.42	0.34	0.12	0.17	#N/A
29 Dec 21 - 12 Jan 22	0.16	#N/A	0.16	#N/A	2.72	#N/A	0.11	#N/A	0.68	0.11
12 Jan 22 - 25 Jan 22	0.18	#N/A	1.48	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
25 Jan 22 - 9 Feb 22	#N/A	#N/A	0.59	0.05	0.14	0.03			0.01	0.01
9 Feb 22 - 23 Feb 22	0.11	#N/A	0.08	0.08	0.17	0.14	0.03	0.07	0.38	0.44
9 Mar 22-23 Mar 22	0.08	#N/A	0.06	0.01	0.47	1.50	0.06	0.11	0.06	0.03
23 March 22 - 5 April 22	0.03	0.09	0.09	0.24	0.33	1.68	0.06	#N/A	1.12	0.03
5 April 22 - 20 April 22	0.10	0.10	0.20	0.18	0.13	0.08	0.05	0.05	0.10	0.10
20 April 22 - 4 May 22	0.31	0.06	0.03	0.06	0.06	#N/A	0.03	#N/A	0.20	0.32
4 May 22 - 19 May 22	0.17	0.14	0.89	0.60	0.04	0.09	0.005	0.03	0.68	0.09
19 May 22 - 1 June 22	0.47	0.05	0.31	#N/A	0.22	0.10			0.08	0.08
1 June 22 - 15 June 22	0.15	0.43	0.04	0.46	0.15	0.48			0.01	0.23
15 June 22 - 29 June 22	0.03	0.03	0.23	0.01	0.08	0.03	0.08	0.01	0.03	0.01
29 June 22 - 18 July 22	0.48	0.02	0.02	0.02	0.01	0.02	0.02	0.01	0.08	0.08
18 July 2022 - 27 July 22	0.05	0.18	0.09	0.17	0.05	0.41	0.04	0.04	0.02	0.05
27 July 2022 - 10 Aug 22	0.03	0.03	0.01	0.03	0.51	#N/A	0.03	0.03	0.22	0.16
10 Aug 22 - 24 Aug 22	0.14	0.03	0.03	0.14	0.01	0.03	0.03	0.03	0.03	0.01
24 Aug 22 - 9 Sep 22	0.04	0.02	0.02	0.02	0.02	0.02	0.04	0.07	0.07	0.07

NH_3 µg/m^3 Nominal 15 day average										
Sampling dates	**KBSF Quarry**	**KBSF Quarry - Dup**	**Mt Wongama**	**Mt Wongama - Dup**	**Visitor Centre**	**Visitor Centre - Dup**	**RT Pastoral Lease**	**RT Pastoral Lease - Dup**	**AAQ Station**	**AAQ Station - Dup**
29 Sep 21 - 14 Oct 21	0.39	0.34	0.18	0.18	0.20	0.23	0.11	0.11	0.20	0.20
14 Oct 21 - 1 Nov 21	0.23	0.23	0.19	#N/A	0.15	0.17	0.13	0.11	0.29	0.29
1 Nov 21 - 15 Nov 21	0.22	0.20	0.19	0.19	0.22	0.19	0.12	0.07	0.20	0.22
15 Nov 21 - 29 Nov 21	0.42	0.42	#N/A	0.30	0.32	0.32	0.19	0.22	0.29	0.29
29 Nov 21 - 13 Dec 21	0.38	0.32	0.37	0.37	0.32	0.32	0.25	0.22	0.35	0.35
13 Dec 21 - 29 Dec 21	0.26	0.23	0.42	0.40	0.26	0.28	0.30	0.30	0.30	0.28
29 Dec 21 - 12 Jan 22	0.37	#N/A	0.26	#N/A	0.27	#N/A	0.35	#N/A	0.25	#N/A
12 Jan 22 - 25 Jan 22	4.07	#N/A	0.40	#N/A	1.05	#N/A	0.32	#N/A	1.07	1.12
25 Jan 22 - 9 Feb 22	0.37	0.37	0.23	0.23	0.60	0.62	0.52	0.54	0.35	0.35
9 Feb 22 - 23 Feb 22	1.55	#N/A	0.49	0.49	1.23	1.21			1.78	1.70
23 Feb 22 - 9 March 22	0.95	0.95	0.47	0.47	0.56	0.56	0.36	0.41	0.58	0.56
9 March 22-23 March 22	1.11	1.09	1.16	1.20	0.99	0.99	0.32	0.32	1.16	1.16
23 March 22 - 5 April 22	0.57	0.65	0.38	0.38	0.64	0.64	0.29	0.32	0.42	0.37
5 April 22 - 20 April 22	0.51	0.49	1.45	1.41	0.44	0.44	0.18	0.18	0.44	0.56
20 April 22 - 4 May 22	2.09	*0.05*	0.86	0.91	0.71	0.71	0.42	0.42	0.78	0.81
4 May 22 - 19 May 22	1.65	3.51	0.23	0.21	0.30	0.26			0.34	0.34
19 May 22 - 1 June 22	3.55	3.55	0.42	0.31	0.83	0.83	0.38	0.33	1.16	0.77
1 June 22 - 15 June 22	2.76	2.50	0.11	*0.05*	0.22	0.19			0.29	0.26
15 June 22 - 29 June 22	2.39	2.36	0.15	0.12	0.42	0.53	0.16	0.14	0.71	0.71
29 June 22 - 18 July 22	1.68	1.75	0.06	0.06	0.51	0.49	0.07	0.07	0.56	0.54
18 July 2022 - 27 July 22	0.85	0.77	0.*08*	*0.08*	0.15	0.19	*0.08*	*0.08*	0.27	#N/A
27 July 2022 - 10 Aug 22	0.80	0.85	0.24	0.22	0.21	0.21	0.23	0.25	0.16	0.24
10 Aug 22 - 24 Aug 22	1.24	1.18	0.05	0.09	0.19	0.17	0.12	0.14	0.29	0.29
24 Aug 22 - 9 Sep 22	0.70	0.80	0.11	*0.07*	*0.06*	*0.07*	1.91*	0.29	0.37	0.35

Non-detect values presented as 0.5 times limit of detection

*Probable outlier excluded from compiled dataset

Appendix C Gaseous data Gradko samplers

Sampling dates	NO_2 µg/m³									
	KBSF Quarry	KBSF Quarry Duplicate	Mt Wongama	Mt Wongama Duplicate	Visitor centre	Visitor centre Duplicate	RT Pastoral Lease	RT Pastoral Lease duplicate	AAQ Station	AAQ station Duplicate
29 Sep 21 – 1 Nov 21	7.0	5.5	5.5	5.7	5.6	6.4	#N/A	#N/A	#N/A	3.7
1-Nov 21 - 29 Nov 21	7.1	11.0	8.0	3.9	3.9	9.5	4.2	3.9	5.1	5.8
29-Nov 21-29-Dec-21	6.7	7.4	8.3	8.9	7.2	5.1	0.1	0.3	4.2	5.9
29 Dec 21 - 25 Jan 22	1.0	#N/A	0.3	#N/A	1.2	#N/A	1.0	#N/A	1.3	0.3
25 Jan 22 - 23 Feb 22	1.6	#N/A	0.4	#N/A	2.6	#N/A	0.3	#N/A	2.3	1.8
23 Feb 22 - 23 Mar 22	3.4	#N/A	1.4	#N/A	4.1	#N/A	0.4	#N/A	2.8	4.1
5 April 22 - 20 April 22	3.1	#N/A	0.7	#N/A	3.3	#N/A	0.6	#N/A	2.6	3.4
20 April 22 - 19 May 22	29.3	#N/A	0.8	#N/A	3.3	#N/A	1.7	#N/A	3.2	3.1
19 May 22 - 15 June 22	6.0	#N/A	0.7	#N/A	1.3	#N/A		#N/A	2.1	2.7

Sampling dates	HNO_3 µg/m³									
	KBSF Quarry	KBSF Quarry Duplicate	Mt Wongama	Mt Wongama Duplicate	Visitor centre	Visitor centre Duplicate	RT Pastoral Lease	RT Pastoral Lease duplicate	AAQ Station	AAQ station Duplicate
29 Sep 21 – 1 Nov 21	6.2	5.0	4.4	6.9	4.9	3.2	3.7	4.2	6.9	2.5
1-Nov 21 - 29 Nov 21	4.8	5.5	4.2	9.2	4.4	9.1	8.1	5.7	4.9	5.1
29-Nov 21-29-Dec-21	8.9	5.1	4.4	5.3	5.0	6.0	4.7	3.6	7.6	4.9
29 Dec 21 - 25 Jan 22	12.1	#N/A	5.4	#N/A	8.3	#N/A	8.4	#N/A	8.3	5.8
25 Jan 22 - 23 Feb 22	11.3	#N/A	10.2	#N/A	14.2	#N/A	9.2	#N/A	8.0	15.8
23 Feb 22 - 23 Mar 22	17.8	#N/A	12.1	#N/A	16.1	#N/A	15.7	#N/A	16.4	12.8
5 April 22 - 20 April 22	35.5	#N/A	32.8	#N/A	18.8	#N/A	18.0	#N/A	25.5	16.5
20 April 22 - 19 May 22	11.0	#N/A	16.1	#N/A	10.8	#N/A	<2.0	#N/A	11.5	16.1
19 May 22 - 15 June 22	13.1	#N/A	10.1	#N/A	5.2	#N/A		#N/A	9.4	15.0

Sampling dates	SO_2 µg/m³									
	KBSF Quarry	KBSF Quarry Duplicate	Mt Wongama	Mt Wongama Duplicate	Visitor centre	Visitor centre Duplicate	RT Pastoral Lease	RT Pastoral Lease duplicate	AAQ Station	AAQ station Duplicate
29 Sep 21 - 1 Nov 21	2.8	4.5	9.6	6.8	5.6	8.2	6.3	8.4	5.9	9.0
1-Nov 21 - 29 Nov 21	13.7	46.8	13.5	1.6	16.2	1.6	2.8	12.7	13.1	1.8
29-Nov 21-29-Dec-21	1.7	2.9	2.0	2.3	1.7	3.3	1.7	1.9	2.3	1.6
29 Dec 21 - 25 Jan 22	12.3	#N/A	13.4	#N/A	4.1	#N/A	14.0	#N/A	7.6	19.4
25 Jan 22 - 23 Feb 22	3.7	#N/A	7.7	#N/A	15.1	#N/A	12.6	#N/A	12.4	9.6
23 Feb 22 - 23 Mar 22	15.7	#N/A	8.8	#N/A	9.7	#N/A	9.4	#N/A	15.9	9.5
5 April 22 - 20 April 22	4.8	#N/A	5.6	#N/A	7.8	#N/A	5.8	#N/A	11.3	7.2
20 April 22 - 19 May 22	3.6	#N/A	2.3	#N/A	2.3	#N/A		#N/A	2.5	2.7
19 May 22 - 15 June 22	2.6	#N/A	2.2	#N/A	2.4	#N/A	1.5	#N/A	3.0	2.0

Sampling dates	NH_3 µg/m³									
	KBSF Quarry	KBSF Quarry Duplicate	Mt Wongama	Mt Wongama Duplicate	Visitor centre	Visitor centre Duplicate	RT Pastoral Lease	RT Pastoral Lease duplicate	AAQ Station	AAQ station Duplicate
29 Sep 21 – 1 Nov 21	3.8	3.8	3.4	3.8	3.9	3.9	3.8	4.2	4.7	5.1
1-Nov 21 - 29 Nov 21	2.9	5.6	2.7	2.8	3.1	3.3	3.6	2.9	3.3	3.1
29-Nov 21-29-Dec-21	4.8	5.3	6.0	5.3	5.5	5.1	4.5	4.4	5.2	4.9
29 Dec 21 - 25 Jan 22	7.3	#N/A	6.0	#N/A	6.0	#N/A	8.0	#N/A	7.2	7.6
25 Jan 22 - 23 Feb 22	6.5	#N/A	6.8	#N/A	6.8	#N/A	5.1	#N/A	8.3	7.4
23 Feb 22 - 23 Mar 22	9.6	#N/A	7.5	#N/A	8.5	#N/A	7.7	#N/A	10.4	7.7
5 April 22 - 20 April 22	9.9	#N/A	11.8	#N/A	7.6	#N/A	7.9	#N/A	7.7	8.0
20 April 22 - 19 May 22	7.7	#N/A	6.1	#N/A	6.0	#N/A	4.0	#N/A	6.1	5.9
19 May 22 - 15 June 22	10.7	#N/A	5.7	#N/A	#N/A	#N/A		#N/A	8.3	7.8

Appendix D Gaseous data Ferm samplers

Sampling dates	NO_2 µg/m³									
	KBSF Quarry	KBSF Quarry Duplicate	Mt Wongama	Mt Wongama Duplicate	Visitor centre	Visitor centre Duplicate	RT Pastoral Lease	RT Pastoral Lease duplicate	AAQ Station	AAQ station Duplicate
29 Sep 21 - 1 Nov 21	4.4	4.7	3.5	3.5	4.1	3.6	0.6	0.9	3.6	3.7
1-Nov 21 - 29 Nov 21	4.9	5.0	2.4	1.1	4.2	3.9	0.9	0.8	3.7	3.5
29 Nov 21 - 29 Dec 21	5.1	5.1	4.8	5.2	3.6	3.6	1.2	1.2	3.8	3.9
29 Dec 21 - 25 Jan 22	2.7	#N/A	1.6	#N/A	2.4	#N/A	0.9	#N/A	2.4	2.4
25 Jan 22 - 23 Feb 22	3.0	#N/A	1.6	#N/A	3.2	#N/A	1.4	#N/A	2.7	2.7
23 Feb 22 - 23 Mar 22	3.1	#N/A	2.1	#N/A	3.8	#N/A	1.2	#N/A	3.4	2.9
23 Mar 22 - 20 April 22	3.7	#N/A	2.7	#N/A	3.8	#N/A	1.5	#N/A	3.8	3.8
20 April 22 - 19 May 22	4.3	#N/A	2.3	#N/A	3.3	#N/A	1.5	#N/A	3.0	3.5
19 May 22 - 15 June 22	5.5	#N/A	1.9	#N/A	2.2	#N/A	1.4	#N/A	2.6	2.6
15 June 22 - 18 July 22	4.8	#N/A	1.2	#N/A	1.5	#N/A	1.0	#N/A	1.9	1.8
18 July 22 - 10 Augu 22	6.6	#N/A	3.0	#N/A	4.0	#N/A	1.5	#N/A	4.4	4.6
10 Aug 22 - 4 Sep 22	4.2	#N/A	1.8	#N/A	3.2	#N/A	1.1	#N/A	2.7	2.9

Sampling dates	HNO_3 µg/m³									
	KBSF Quarry	KBSF Quarry Duplicate	Mt Wongama	Mt Wongama Duplicate	Visitor centre	Visitor centre Duplicate	RT Pastoral Lease	RT Pastoral Lease duplicate	AAQ Station	AAQ station Duplicate
29 Sep 21 - 1 Nov 21	0.2	0.2	0.2	0.3	0.3	0.2	0.3	0.3	0.3	0.4
1-Nov 21 - 29 Nov 21	0.1	0.1	0.3	0.3	0.2	0.2	0.5	0.4	0.4	0.4
29 Nov 21 - 29 Dec 21	0.2	0.1	0.3	0.2	0.3	0.2	0.5	0.4	0.2	0.3
29 Dec 21 - 25 Jan 22	0.0	#N/A	0.1	#N/A	0.0	#N/A	0.2	#N/A	0.1	0.1
25 Jan 22 - 23 Feb 22	0.3	#N/A	0.3	#N/A	0.2	#N/A	0.2	#N/A	0.4	0.5
23 Feb 22 - 23 Mar 22	0.6	#N/A	0.4	#N/A	0.6	#N/A	0.5	#N/A	0.6	0.7
23 Mar 22 - 20 April -22	0.4	#N/A	0.6	#N/A	0.5	#N/A	0.5	#N/A	0.4	0.6
20 April 22 - 19 May 22	0.4	#N/A	0.5	#N/A	0.4	#N/A	0.4	#N/A	0.6	0.5
19 May 22 - 15 June 22	0.2	#N/A	0.3	#N/A	0.3	#N/A	0.4	#N/A	0.3	0.4
15 June 22 - 18 July 22	0.3	#N/A	0.3	#N/A	0.4	#N/A	0.3	#N/A	0.3	0.3
18 July 22 - 10 August 22	0.4	#N/A	0.5	#N/A	0.5	#N/A	0.3	#N/A	0.3	0.4
10 Aug 22 - 4 Sep 22	0.2	#N/A	0.18	#N/A	0.3	#N/A	0.2	#N/A	0.3	0.3

Sampling dates	SO_2 µg/m³									
	KBSF Quarry	KBSF Quarry Duplicate	Mt Wongama	Mt Wongama Duplicate	Visitor centre	Visitor centre Duplicate	RT Pastoral Lease	RT Pastoral Lease duplicate	AAQ Station	AAQ station Duplicate
29 Sep 21 - 1 Nov 21	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	0.2	0.3
1 Nov 21 - 20 Nov 21	0.1	0.1	0.1	0.1	0.1	0.2	<0.09	0.1	0.1	0.2
29 Nov 21 - 29 Dec 21	0.3	0.4	0.3	0.3	0.4	0.3	0.1	0.1	0.5	0.3
29 Dec 21 - 25 Jan 22	0.2	#N/A	0.2	#N/A	0.2	#N/A	0.2	#N/A	0.3	0.3
25 Jan 22 - 23 Feb 22	0.1	#N/A	0.1	#N/A	0.2	#N/A	0.4	#N/A	0.2	0.2
23 Feb 22 - 23 Mar 22	0.2	#N/A	0.3	#N/A	0.2	#N/A	0.1	#N/A	0.3	0.2
23 Mar 22 - 20 April -22	0.2	#N/A	0.1	#N/A	0.1	#N/A	<0.09	#N/A	0.1	0.2
20 April 22 - 19 May 22	0.0	#N/A	0.0	#N/A	<0.09	#N/A	0.0	#N/A	0.0	0.0
19 May 22 - 15 June 22	0.1	#N/A	0.2	#N/A	0.1	#N/A	0.0	#N/A	0.1	0.1
15 June 22 - 18 July 22	0.2	#N/A	0.1	#N/A	0.2	#N/A	0.1	#N/A	0.1	0.1
18 July 22 - 10 August 22	0.3	#N/A	0.2	#N/A	0.4	#N/A	0.0	#N/A	0.3	0.3
10 Aug 22 - 4 Sep 22	0.1	#N/A	0.2	#N/A	0.2	#N/A	<0.09	#N/A	0.1	0.2

	NH_3 µg/m³									
Sampling dates	KBSF Quarry	KBSF Quarry Duplicate	Mt Wongama	Mt Wongama Duplicate	Visitor centre	Visitor centre Duplicate	RT Pastoral Lease	RT Pastoral Lease duplicate	AAQ Station	AAQ station Duplicate
29 Sep 21 – 1 Nov 21	0.2	0.2	0.1	<0.5	0.0	0.0	<0.4	0.0	0.5	1.0
1 Nov 21 – 29 Nov 21	0.1	0.0	<0.5	0.4	0.1	0.1	0.1	<0.5	0.0	0.0
29 Nov 21 - 29 Dec 21	-0.1	0.3	-0.2	0.1	-0.1	0.0	0.3	1.1	0.3	-0.1
29 Dec 21 - 25 Jan 22	1.8	#N/A	0.4	#N/A	0.4	#N/A	0.3	#N/A	0.3	0.5
25 Jan 22 - 23 Feb 22	0.6	#N/A	-0.1	#N/A	0.8	#N/A	0.4	#N/A	0.8	0.5
23 Feb 22 - 23 Mar 22	<0.5	#N/A	-0.2	#N/A	-0.3	#N/A	0.5	#N/A	0.2	-0.5
23 Mar 22 - 20 April 22	0.5	#N/A	1.2	#N/A	0.5	#N/A	0.2	#N/A	0.6	0.4
20 April 22 - 19 May 22	1.5	#N/A	0.8	#N/A	0.1	#N/A	-0.6	#N/A	0.0	0.1
19 May 22 - 15 June 22	4.1	#N/A	0.7	#N/A	1.4	#N/A	-0.1	#N/A	1.1	1.2
15 June 22 - 18 July 22	2.4	#N/A	<0.2	#N/A	0.7	#N/A	0.4	#N/A	0.8	0.6
18 July 22 - 10 Aug 22	1.0	#N/A	0.3	#N/A	0.9	#N/A	0.6	#N/A	0.3	0.3
10 Aug 22 - 4 Sep 22	0.0	#N/A	0.2	#N/A	-0.1	#N/A	0.6	#N/A	0.0	0.0

Appendix E Dust deposition data

KBSF Quarry						
Sampling Start Date	Sample Start Time	Sample Finish Date	Sample Finish Time	Insoluble Solids g/m^2/month	Soluble Solids g/m^2/month	Total Solids g/m^2/month
29/09/2021	14:45	1/11/2021	15:50	1.1	0.2	1.3
1/11/2021	15:50	29/11/2021	10:20	3.4	< 0.1	3.5
29/11/2021	10:20	29/12/2021	9:15	2.6	< 0.1	2.5
29/12/2021	9:15	25/01/2021	6:30	1	2	3
25/01/2021	6:30	23/02/2022	10:00	1.7	0.6	2.3
23/02/2022	10:00	23/03/2022	6:15	1.4	< 0.1	1.4
23/03/2022	6:15	20/04/2022	6:30	2.6	0.3	2.8
20/04/2022	6:30	19/05/2022	8:00	1.5	1.6	3.2
19/05/2022	8:00	15/06/2022	5:00	4.2	1.6	5.8
15/06/2022	5:00	18/07/2022	14:30	1	1.4	2.4
18/07/2022	14:30	10/08/2022	18:45	1.2	1.3	2.5
10/08/2022	18:45	4/09/2022	6:30	1.8	0.7	2.5

Mt Wongama						
Sampling Start Date	Sample Start Time	Sample Finish Date	Sample Finish Time	Insoluble Solids g/m^2/month	Soluble Solids g/m^2/month	Total Solids g/m^2/month
29/09/2021	14:20	1/11/2021	14:40	0.6	0.2	0.8
1/11/2021	14:40	29/11/2021	14:00	3.9	2.8	6.7
29/11/2021	14:00	29/12/2021	11:35	1.8	0.2	1.9
29/12/2021	11:35	25/01/2021	14:20	1.4	1.5	2.9
25/01/2021	14:20	23/02/2022	11:45	1.3	0.3	1.7
23/02/2022	11:45	23/03/2022	11:30	1	0.4	1.4
23/03/2022	11:30	20/04/2022	17:15	1.2	0.3	1.5
20/04/2022	17:15	19/05/2022	9:45	1.1	3.3	4.4
19/05/2022	9:45	15/06/2022	17:50	1.9	2.5	4.4
15/06/2022	17:50	18/07/2022	16:00	0.9	1.6	2.5
18/07/2022	16:00	10/08/2022	17:10	0.5	< 0.1	0.6
10/08/2022	17:10	4/09/2022	17:30	0.5	0.8	1.3

Visitor Centre						
Sampling Start Date	Sample Start Time	Sample Finish Date	Sample Finish Time	Insoluble Solids g/m^2/month	Soluble Solids g/m^2/month	Total Solids g/m^2/month
29/09/2021	13:00	1/11/2021	13:16	1.1	0.5	1.6
1/11/2021	13:16	29/11/2021	13:00	1.5	0.7	2.2
29/11/2021	13:00	29/12/2021	12:20	1.5	< 0.1	1.5
29/12/2021	12:20	25/01/2021	13:00	0.9	1.5	2.4
25/01/2021	13:00	23/02/2022	12:40	2.1	1.1	3.2
23/02/2022	12:40	23/03/2022	7:15	0.7	< 0.1	0.7
23/03/2022	7:15	20/04/2022	17:15	< 0.1	< 0.1	< 0.1
20/04/2022	19:00	19/05/2022	11:00	0.7	0.4	1.1
19/05/2022	11:00	15/06/2022	18:15	1	0.9	1.9
15/06/2022	18:15	18/07/2022	16:45	0.7	0.7	1.4
18/07/2022	16:45	10/08/2022	17:50	0.6	0.6	1.2
10/08/2022	17:50	4/09/2022	18:00	0.5	0.2	0.7

RT Pastoral Lease						
Sampling Start Date	Sample Start Time	Sample Finish Date	Sample Finish Time	Insoluble Solids g/m^2/month	Soluble Solids g/m^2/month	Total Solids g/m^2/month
1/11/2021	17:35	29/11/2021	8:30	0.9	0.5	1.3
29/11/2021	8:30	29/12/2021	7:45	2.2	< 0.1	2
29/12/2021	7:45	25/01/2021	5:00	1.2	1.4	2.6
25/01/2021	5:00	23/02/2022	14:30	7	0.4	7.4
23/02/2022	14:30	23/03/2022	5:20	0.5	< 0.1	0.5
23/03/2022	5:20	20/04/2022	5:30	1.6	< 0.1	1.6
20/04/2022	5:30	15/06/2022	6:00	1.2	0.4	1.6
20/05/2022	5:30	15/06/2022	6:00			
15/06/2022	6:00	18/07/2022	12:30	0.7	0.4	1.1
18/07/2022	12:30	10/08/2022	5:30	0.5	1.1	1.6
10/08/2022	5:30	4/09/2022	5:30	0.4	< 0.1	0.4

AAQ Station						
Sampling Start Date	Sample Start Time	Sample Finish Date	Sample Finish Time	Insoluble Solids g/m^2/month	Soluble Solids g/m^2/month	Total Solids g/m^2/month
29/09/2021	11:40	1/11/2021	11:30	0.6	0.3	0.9
1/11/2021	11:30	29/11/2021	11:40	1	0.7	1.7
29/11/2021	11:40	29/12/2021	10:15	2.6	0.2	2.7
29/12/2021	10:15	25/01/2021	13:30	1.2	1.8	3
25/01/2021	13:30	23/02/2022	10:45	4.1	0.8	4.8
23/02/2022	10:45	23/03/2022	6:50	1.3	0.4	1.6
23/03/2022	6:50	20/04/2022	16:15	1.3	0.4	1.6
20/04/2022	16:15	19/05/2022	8:50	2.5	0.2	2.7
19/05/2022	8:45	15/06/2022	16:40	2.3	1.6	3.8
15/06/2022	16:40	18/07/2022	15:20	0.6	0.4	1
18/07/2022	15:20	10/08/2022	16:30	1	1.2	2.2
10/08/2022	16:30	4/09/2022	16:30	0.5	< 0.1	0.1

Blank						
Sampling Start Date	Sample Start Time	Sample Finish Date	Sample Finish Time	Insoluble Solids g/m^2/month	Soluble Solids g/m^2/month	Total Solids g/m^2/month
29/09/2021	14:45	1/11/2022	15:30	<0.1	<0.1	<0.1
1/11/2021	15:30	29/11/2021	15:50	0.3	0.05	0.3
29/11/2021	10:20	29/12/2021	10:21	0.4	0.1	0.5
29/12/2021	9:15	25/01/2021	13:30	< 0.1	< 0.1	< 0.1
25/01/2021	6:30	23/02/2022	10:45	< 0.1	< 0.1	< 0.1
23/02/2022	10:45	23/03/2022	6:50	< 0.1	< 0.1	< 0.1
23/03/2022	6:15	20/04/2022	16:15	< 0.1	< 0.1	< 0.1
20/04/2022	6:30	19/05/2022	8:50	< 0.1	1.8	1.8
19/05/2022	8:00	25/05/2022	16:40	0.4	0.3	0.7
15/06/2022	5:00	18/07/2022	15:20	< 0.1	< 0.1	< 0.1
18/07/2022	14:30	10/08/2022	16:30	< 0.1	< 0.1	< 0.1
10/08/2022	18:45	4/09/2022	16:30	1.3	1.1	2.4

KBSF Quarry soluble fraction	Units	29/09/2021 - 1/11/2021	29/11/2021- 29/12/2021	29/12/21 - 25/1/22	25/1/22 - 23/2/22	23/2/22 - 23/3/22	23/3/2022 - 20/4/2022	20/4/2021- 19/5/2021	19/5/2022 - 15/6/2022	15/6/2022 - 18/7/2022	18/7/2022 - 10/8/2022	10/8/2022- 4/9/2022
Alkalinity	mg $CaCO_3$/L	< 25	40	< 15	12	< 5	12	10	< 5	6.6	5.6	6.9
Ammonia-N	mg/L	< 0.1	< 0.06	< 0.06	0.05	< 0.02	<0.02	< 0.02	0.08	< 0.02	< 0.02	0.02
Bicarbonate	mg $CaCO_3$/L	< 25	40	< 15	12	< 5	12	10	<5	6.6	5.6	6.9
Calcium - Total	mg/L	11	6.5	2.7	1.8	1.7	4.2	1.6	1.3	3.3	3.1	4.4
Carbonate	mg $CaCO_3$/L	< 25	< 15	< 15	< 5	< 5	<5	< 5	<5	< 5	< 5	< 5
Chloride	mg/L	< 25	< 15	< 15	< 10	12	<5	< 5	<5	9	< 5	< 5
Filterable Reactive Phosphorus	mg/L	-	-	-	-	<0.01	<0.01	< 0.01		< 0.01	0.01	0.01
Hydroxide	mg $CaCO_3$/L	< 25	< 15	< 15	< 5	< 5	<5	< 5	<5	< 5	< 5	< 5
Magnesium - Total	mg/L	1.1	0.7	0.4	0.4	0.5	0.6	0.3	0.3	0.7	< 0.5	1.3
Nitrate-N	mg/L	< 0.05	< 0.03	< 0.03	< 0.02	< 0.01	<0.01	0.12	< 0.01		< 0.01	< 0.01
Nitrite-N	mg/L	< 0.05	< 0.03	< 0.03	< 0.02	< 0.01	<0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
NOx-N	mg/L	< 0.05	< 0.03	< 0.03	< 0.02	< 0.01	<0.01	0.12	< 0.01	< 0.01	< 0.01	< 0.01
Organic Nitrogen	mg/L	< 1	< 0.6	< 0.6	< 0.35	< 0.58	< 0.40	< 0.48	0.52	< 0.40	< 0.28	< 0.2
Potassium - Total	mg/L	0.6	0.3	< 0.3	< 0.2	0.1	0.3	< 0.1	0.2	< 0.5	< 0.5	0.7
Sodium - Total	mg/L	8.9	6.6	6.6	2	4.1	5.6	2.6	4.9	7.2	4.4	8.1
Sulfate	mg/L	< 5	4	< 3	< 2	< 1	<1	1.3	1.2	1.9	< 1	< 1
Total Kjeldahl Nitrogen*	mg/L	< 1	< 0.6	< 0.6	< 0.4	0.6	<0.4	0.5	0.6	0.4	0.3	< 0.2
Total Nitrogen	mg/L	< 1	< 0.6	< 0.6	< 0.4	0.6	<0.4	0.6	0.6	0.4	0.3	< 0.2

Mt Wongama soluble fraction	Units	29/09/2021 - 1/11/2021	29/11/2021-29/12/2021	29/12/21 - 25/1/22	25/1/22 - 23/2/22	23/2/22 - 23/3/22	23/3/2022 - 20/4/2022	20/4/2021-19/5/2021	19/5/2022 - 15/6/2022	15/6/2022 - 18/7/2022	18/7/2022 - 10/8/2022	10/8/2022-4/9/2022
Alkalinity	mg $CaCO_3$/L	< 25	< 15	19	5.5	< 5	11	7.5	<5	9.1	7.1	5.9
Ammonia-N	mg/L	0.2	< 0.06	< 0.06	0.04	< 0.02	0.03	0.12	<0.02	< 0.02	< 0.02	< 0.02
Bicarbonate	mg $CaCO_3$/L	< 25	< 15	19	5.5	< 5	11	7.5	<5	9.1	7.1	5.9
Calcium - Total	mg/L	5.8	5.6	4	4.3	1.1	3.7	1.7	1	2.2	2.4	2.1
Carbonate	mg $CaCO_3$/L	< 25	< 15	< 15	< 5	< 5	<5	< 5	<5	< 5	< 5	< 5
Chloride	mg/L	< 25	< 15	< 15	11	< 5	<5	7.5	7.5	8	< 5	5.4
Filterable Reactive Phosphorus	mg/L	-	-	-	-	<0.01	<0.01	< 0.01	<0.01	< 0.01	< 0.01	< 0.01
Hydroxide	mg $CaCO_3$/L	< 25	< 15	< 15	< 5	< 5	<5	< 5	<5	< 5	< 5	< 5
Magnesium - Total	mg/L	0.8	0.7	0.6	0.7	0.3	0.5	0.6	0.6	0.6	< 0.5	< 0.5
Nitrate-N	mg/L	< 0.05	< 0.03	< 0.03	< 0.02	< 0.01	<0.01	0.24	<0.01		< 0.01	< 0.01
Nitrite-N	mg/L	< 0.05	< 0.03	< 0.03	< 0.02	< 0.01	<0.01	< 0.01	<0.01	< 0.01	< 0.01	< 0.01
NOx-N	mg/L	< 0.05	< 0.03	< 0.03	< 0.02	< 0.01	<0.01	0.24	<0.01	< 0.01	< 0.01	< 0.01
Organic Nitrogen	mg/L	< 0.8	< 0.6	< 0.6	< 0.36	< 0.4	< 0.37	1.08	< 0.3	< 0.2	< 0.2	< 0.2
Potassium - Total	mg/L	0.6	0.4	0.4	0.3	0.1	0.3	0.3	0.2	< 0.5	< 0.5	< 0.5
Sodium - Total	mg/L	13	14	13	10	3.5	5	4.4	6.8	6	3.8	5.5
Sulfate	mg/L	< 5	< 3	< 3	< 2	< 1	<1	2.7	2	1.4	< 1	< 1
Total Kjeldahl Nitrogen*	mg/L	< 1	< 0.6	< 0.6	< 0.4	< 0.4	<0.4	1.2	0.3	< 0.2	0.2	< 0.2
Total Nitrogen	mg/L	< 1	< 0.6	< 0.6	< 0.4	< 0.4	<0.4	1.4	0.3	< 0.2	0.2	< 0.2

Visitor Centre soluble fraction	Units	29/09/2021 - 1/11/2021	29/11/2021-29/12/2021	29/12/21 - 25/1/22	25/1/22 - 23/2/22	23/2/22 - 23/3/22	23/3/2022 - 20/4/2022	20/4/2021-19/5/2021	19/5/2022 - 15/6/2022	15/6/2022 - 18/7/2022	18/7/2022 - 10/8/2022	10/8/2022-4/9/2022
Alkalinity	mg $CaCO_3$/L	< 25	< 15	< 15	6.1	< 5	<10	< 5	<5	5.6	7.7	5.3
Ammonia-N	mg/L	0.5	0.25	< 0.06	0.08	0.14	0.04	0.16	0.05	0.18	< 0.02	< 0.02
Bicarbonate	mg $CaCO_3$/L	< 25	< 15	< 15	6.1	< 5	<10	< 5	<5	5.6	7.7	5.3
Calcium - Total	mg/L	16	5.5	2	3.3	1.1	1	0.6	1.2	1.3	2.6	1.6
Carbonate	mg $CaCO_3$/L	< 25	< 15	< 15	< 5	< 5	<5	< 5	<5	< 5	< 5	< 5
Chloride	mg/L	< 25	< 15	< 15	12	< 5	<5	< 5	<5	< 5	5.1	< 5
Filterable Reactive Phosphorus						0.02	0.04	< 0.01	<0.01	< 0.01	< 0.01	< 0.01
Hydroxide	mg $CaCO_3$/L	< 25	< 15	< 15	< 5	< 5	<5	< 5	<5	< 5	< 5	< 5
Magnesium - Total	mg/L	2.1	1.1	0.5	1	0.3	0.4	0.2	0.2	< 0.5	< 0.5	< 0.5
Nitrate-N	mg/L	< 0.05	< 0.03	< 0.03	< 0.02	0.09	0.03	0.12	0.07		< 0.01	< 0.01
Nitrite-N	mg/L	< 0.05	< 0.03	< 0.03	< 0.02	< 0.01	0.02	< 0.01	<0.01	< 0.01	< 0.01	< 0.01
NOx-N	mg/L	< 0.05	< 0.03	< 0.03	< 0.02	0.09	0.04	0.12	0.07	< 0.01	< 0.01	< 0.01
Organic Nitrogen	mg/L	< 0.5	0.75	< 0.6	< 0.32	1.26	1.36	0.64	0.45	0.02	< 0.70	< 0.2
Potassium - Total	mg/L	1.3	0.5	0.3	0.4	0.2	0.2	< 0.1	0.1	1	< 0.5	< 0.5
Sodium - Total	mg/L	18	14	6.5	7	3.3	2.3	1.1	2.3	2.9	5.2	4.4
Sulfate	mg/L	< 5	< 3	< 3	2.9	< 1	<1	< 1	<1	< 1	1.1	< 1
Total Kjeldahl Nitrogen*	mg/L	< 1	1	< 0.6	< 0.4	1.4	1.4	0.8	0.5	0.2	0.7	< 0.2
Total Nitrogen	mg/L	< 1	1	< 0.6	< 0.4	1.5	1.4	0.9	0.6	0.2	0.7	< 0.2

RT Pastoral Lease soluble fraction	Units	29/11/2021-29/12/2021	29/12/21 - 25/1/22	25/1/22 - 23/2/22	23/2/22 - 23/3/22	23/3/2022 - 20/4/2022	20/4/2022 - 15/6/2022	15/6/2022 - 18/7/2022	18/7/2022 - 10/8/2022	10/8/2022-4/9/2022
Alkalinity	mg $CaCO_3$/L	18	< 15	13	6	10	<5	7.3	8	6.1
Ammonia-N	mg/L	0.07	0.15	0.31	0.36	0.12	0.37	0.03	< 0.02	0.03
Bicarbonate	mg $CaCO_3$/L	18	< 15	13	6	10	<5	7.3	8	6.1
Calcium - Total	mg/L	9.4	5.3	2.4	1.2	3.6	0.4	1.1	2.3	3.5
Carbonate	mg $CaCO_3$/L	< 15	< 15	< 5	< 5	<5	<5	< 5	< 5	< 5
Chloride	mg/L	< 15	< 15	< 10	< 5	<5	<5	< 5	< 5	< 5
Filterable Reactive Phosphorus	mg/L	-	-	-	0.03	<0.01	0.05	< 0.01	< 0.01	0.01
Hydroxide	mg $CaCO_3$/L	< 15	< 15	< 5	< 5	<5	<5	< 5	< 5	< 5
Magnesium - Total	mg/L	4.6	0.4	0.3	0.5	0.4	<0.1	< 0.5	< 0.5	< 0.5
Nitrate-N	mg/L	< 0.03	< 0.03	< 0.02	0.08	0.02	<0.01		< 0.01	< 0.01
Nitrite-N	mg/L	< 0.03	< 0.03	< 0.02	< 0.01	0.02	<0.01	< 0.01	< 0.01	< 0.01
NOx-N	mg/L	< 0.03	< 0.03	< 0.02	0.08	0.02	<0.01	< 0.01	< 0.01	< 0.01
Organic Nitrogen	mg/L	0.63	< 0.45	3.59	2.94	< 0.28	0.13	< 0.17	< 0.2	< 0.17
Potassium - Total	mg/L	1.4	0.3	0.2	1.1	0.3	0.2	< 0.5	< 0.5	< 0.5
Sodium - Total	mg/L	16	7.4	2.2	1.8	4.2	0.3	1.9	3.4	4.5
Sulfate	mg/L	10	3	< 2	< 1	<1	< 1	< 1	< 1	< 1
Total Kjeldahl Nitrogen*	mg/L	0.7	< 0.6	3.9	3.3	<0.4	0.5	< 0.2	< 0.2	< 0.2
Total Nitrogen	mg/L	0.7	< 0.6	3.9	3.4	<0.4	0.5	< 0.2	< 0.2	< 0.2

AAQ Station soluble fraction	Units	29/09/2021 - 1/11/2021	29/11/2021-29/12/2021	29/12/21 - 25/1/22	25/1/22 - 23/2/22	23/2/22 - 23/3/22	23/3/2022 - 20/4/2022	20/4/2021-19/5/2021	19/5/2022 - 15/6/2022	15/6/2022 - 18/7/2022	18/7/2022 - 10/8/2022	10/8/2022-4/9/2022
Alkalinity	mg $CaCO_3$/L	< 25	< 15	< 15	5.4	< 5	<10	< 5	< 5	6.4	6.7	5.7
Ammonia-N	mg/L	< 0.1	< 0.06	< 0.06	0.31	< 0.02	<0.02	< 0.02	0.17	< 0.02	< 0.02	< 0.02
Bicarbonate	mg $CaCO_3$/L	< 25	< 15	< 15	5.4	< 5	<10	< 5	< 5	6.4	6.7	5.7
Calcium - Total	mg/L	3.7	5.2	3.8	4.5	1.6	6.6	1.2	1	1.4	2.5	1.8
Carbonate	mg $CaCO_3$/L	< 25	< 15	< 15	< 5	< 5	<5	< 5	< 5	< 5	< 5	< 5
Chloride	mg/L	< 25	< 15	< 15	< 10	< 5	<5	< 5	< 5	< 5	< 5	< 5
Filterable Reactive Phosphorus	mg/L	-	-	-	-	<0.01	<0.01	< 0.01	<0.01	< 0.01	< 0.01	< 0.01
Hydroxide	mg $CaCO_3$/L	< 25	< 15	< 15	< 5	< 5	<5	< 5	< 5	< 5	< 5	< 5
Magnesium - Total	mg/L	1.1	0.8	0.6	0.8	0.5	0.8	0.2	0.3	< 0.5	< 0.5	< 0.5
Nitrate-N	mg/L	< 0.05	< 0.03	< 0.03	< 0.02	< 0.01	0.01	< 0.01	< 0.01		< 0.01	< 0.01
Nitrite-N	mg/L	< 0.05	< 0.03	< 0.03	< 0.02	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
NOx-N	mg/L	< 0.05	< 0.03	< 0.03	< 0.02	< 0.01	0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01
Organic Nitrogen	mg/L	< 1	< 0.6	< 0.6	< 0.09	< 0.4	<0.4	< 0.2	0.43	< 0.2	< 0.28	< 0.2
Potassium - Total	mg/L	0.5	0.4	0.3	0.3	0.1	0.3	< 0.1	0.1	< 0.5	< 0.5	< 0.5
Sodium - Total	mg/L	7.4	15	7.9	7.1	4.1	7.5	1.9	1.4	3.2	3.9	5
Sulfate	mg/L	< 5	< 3	< 3	3.2	1	<1	< 1	<1	< 1	< 1	< 1
Total Kjeldahl Nitrogen*	mg/L	< 1	< 0.6	< 0.6	< 0.4	< 0.4	<0.4	< 0.2	0.6	< 0.2	0.3	< 0.2
Total Nitrogen	mg/L	< 1	< 0.6	< 0.6	< 0.4	< 0.4	<0.4	< 0.2	0.6	< 0.2	0.3	< 0.2

Blank soluble fraction	Units	29/09/2021 - 1/11/2021	29/11/2021-29/12/2021	29/12/21 - 25/1/22	25/1/22 - 23/2/22	23/2/22 - 23/3/22	23/3/2022 - 20/4/2022	20/4/2021-19/5/2021	19/5/2022 - 15/6/2022	15/6/2022 - 18/7/2022	18/7/2022 - 10/8/2022	10/8/2022-4/9/2022
Alkalinity	mg $CaCO_3$/L	< 25	< 500	< 15	< 5	< 5	<10	< 5	< 5	< 5	< 5	< 5
Ammonia-N	mg/L	< 0.1	< 2	< 0.06	< 0.04	< 0.02	<0.02	< 0.02	<0.02	< 0.02	0.02	< 0.02
Bicarbonate	mg $CaCO_3$/L	< 25	< 500	< 15	< 5	< 5	<10	< 5	<5	< 5	< 5	< 5
Calcium - Total	mg/L	0.3	< 10	< 0.3	< 0.2	0.2	0.3	0.2	0.2	< 0.5	< 0.5	1.6
Carbonate	mg $CaCO_3$/L	< 25	< 500	< 15	< 5	< 5	<5	< 5	< 5	< 5	< 5	< 5
Chloride	mg/L	< 25	< 500	< 15	< 10	< 5	<5	< 5	< 5	< 5	< 5	< 5
Filterable Reactive Phosphorus	mg/L	-	-	-	-	0.04	0.02	0.13	<0.01	< 0.01	< 0.01	< 0.01
Hydroxide	mg $CaCO_3$/L	< 25	< 500	< 15	< 5	< 5	<5	< 5	< 5	< 5	< 5	< 5
Magnesium - Total	mg/L	< 0.1	< 10	< 0.3	< 0.2	0.2	<0.2	< 0.1	<0.1	< 0.5	< 0.5	< 0.5
Nitrate-N	mg/L	< 0.05	< 1	< 0.03	< 0.02	< 0.01	0.04	< 0.01	<0.1		< 0.01	< 0.01
Nitrite-N	mg/L	< 0.05	< 1	< 0.03	< 0.02	< 0.01	0.02	< 0.01	<0.1	< 0.01	< 0.01	< 0.01
NOx-N	mg/L	< 0.05	< 1	< 0.03	< 0.02	< 0.01	0.05	< 0.01	<0.1	< 0.01	< 0.01	< 0.01
Organic Nitrogen	mg/L	< 1	< 200	< 0.6	< 0.4	< 0.4	<0.4	1.1	<0.2	< 0.2	< 0.2	< 0.2
Potassium - Total	mg/L	< 0.1	< 10	< 0.3	< 0.2	< 0.1	<0.2	< 0.1	<0.1	< 0.5	< 0.5	< 0.5
Sodium - Total	mg/L	1.6	< 10	< 0.3	< 0.2	< 0.1	0.7	0.1	<0.1	1.2	0.7	3.7
Sulfate	mg/L	< 5	< 100	< 3	< 2	< 1	<1	< 1	<1	< 1	< 1	< 1
Total Kjeldahl Nitrogen*	mg/L	< 1	< 200	< 0.6	< 0.4	< 0.4	<0.4	1.1	<0.2	< 0.2	< 0.2	< 0.2
Total Nitrogen	mg/L	< 1	< 200	< 0.6	< 0.4	< 0.4	<0.4	1.1	<0.2	< 0.2	< 0.2	< 0.2

Appendix F Rainwater data

Parameter	Units	KBSF Quarry		
		11/02/2022	19/05/2022	15/06/2022
Volume	mL	1000	8000-9000	8000
Ammonia-N	mg/L	0.03	0.07	0.17
Calcium (filtered)	mg/L	3.5	0.3	0.4
Chloride	mg/L	6.2	5.5	< 5
Filterable Reactive Phosphorus	mg/L	< 0.01	< 0.01	< 0.01
Magnesium (filtered)	mg/L	0.5	0.1	0.2
Nitrate-N	mg/L	0.29	0.12	< 0.01
Nitrite-N	mg/L	< 0.01	< 0.01	< 0.01
NOx-N	mg/L	0.29	0.12	< 0.01
pH	pH units	6.1	5.8	6.4
Potassium (filtered)	mg/L	0.5	0.2	0.2
Sodium (filtered)	mg/L	4.9	330	1.2
Sulfate	mg/L	2.8	1.4	< 1
Total Kjeldahl Nitrogen	mg/L	0.2	< 0.2	0.4
Total Nitrogen	mg/L	0.5	0.3	0.4
Alkalinity	mg CaCO3/L	12	< 5	< 5
Bicarbonate	mg CaCO3/L	12	< 5	< 5
Carbonate	mg CaCO3/L	< 5	< 5	< 5
Hydroxide	mg CaCO3/L	< 5	< 5	< 5
Acetic Acid*	mg/L	6	< 1	15
Butyric Acid*	mg/L	< 2	< 2	< 2
Caproic Acid*	mg/L	< 5	< 5	< 5
Formic Acid*	mg/L	2	< 1	< 1
Heptanoic Acid*	mg/L	< 5	< 5	< 5
Isobutyric Acid*	mg/L	< 2	< 2	< 2
Isocaproic Acid*	mg/L	< 5	< 5	< 5
Isovaleric Acid*	mg/L	< 2	< 2	< 2
Propionic Acid*	mg/L	< 2	< 2	< 2
Total VFA (as acetic acid)	mg/L	< 18	< 18	< 18
Valeric Acid*	mg/L	< 5	< 5	< 5

*Not covered by Eurofins NATA accreditation

Parameter	Units	Mt Wongama		
		13/02/2022	19/05/2022	15/06/2022
Volume	mL	260	8000-9000	9000
Ammonia-N	mg/L	0.05	0.05	0.03
Calcium (filtered)	mg/L	1.6	0.3	0.3
Chloride	mg/L	< 5	5.8	5.5
Filterable Reactive Phosphorus	mg/L	< 0.01	< 0.01	< 0.01
Magnesium (filtered)	mg/L	0.4	0.4	0.4
Nitrate-N	mg/L	0.4	0.06	0.01
Nitrite-N	mg/L	< 0.01	< 0.01	< 0.01
NOx-N	mg/L	0.4	0.06	0.01
pH	pH units	5.9	5.6	5.8
Potassium (filtered)	mg/L	0.3	0.3	0.2
Sodium (filtered)	mg/L	3.8	2.9	2.6
Sulfate	mg/L	1.8	1.3	1.6
Total Kjeldahl Nitrogen	mg/L	0.3	< 0.2	< 0.2
Total Nitrogen	mg/L	0.7	0.2	< 0.2
Alkalinity	mg CaCO3/L	5.2	< 5	< 5
Bicarbonate	mg CaCO3/L	5.2	< 5	< 5
Carbonate	mg CaCO3/L	< 5	< 5	< 5
Hydroxide	mg CaCO3/L	< 5	< 5	< 5
Acetic Acid*	mg/L	4	< 1	15
Butyric Acid*	mg/L	< 2	< 2	< 2
Caproic Acid*	mg/L	< 5	< 5	< 5
Formic Acid*	mg/L	2	< 1	< 1
Heptanoic Acid*	mg/L	< 5	< 5	< 5
Isobutyric Acid*	mg/L	< 2	< 2	< 2
Isocaproic Acid*	mg/L	< 5	< 5	< 5
Isovaleric Acid*	mg/L	< 2	< 2	< 2
Propionic Acid*	mg/L	< 2	< 2	< 2
Total VFA (as acetic acid)	mg/L	< 18	< 18	< 18
Valeric Acid*	mg/L	< 5	< 5	< 5

Parameter	Units	Visitor Centre		
		11/02/2022	19/05/2022	15/06/2022
Volume	mL	1200	8000-9000	9000
Ammonia-N	mg/L	0.14	0.06	0.05
Calcium (filtered)	mg/L	0.5	0.3	0.1
Chloride	mg/L	< 5	< 5	< 5
Filterable Reactive Phosphorus	mg/L	< 0.01	< 0.01	< 0.01
Magnesium (filtered)	mg/L	0.1	0.2	0.1
Nitrate-N	mg/L	0.21	0.02	< 0.01
Nitrite-N	mg/L	< 0.01	< 0.01	< 0.01
NOx-N	mg/L	0.21	0.03	< 0.01
pH	pH units	5.8	5.5	5.7
Potassium (filtered)	mg/L	< 0.1	0.2	0.1
Sodium (filtered)	mg/L	1.6	1.9	1
Sulfate	mg/L	< 1	< 1	< 1
Total Kjeldahl Nitrogen	mg/L	< 0.2	< 0.2	< 0.2
Total Nitrogen	mg/L	0.4	< 0.2	< 0.2
Alkalinity	mg CaCO3/L	< 5	< 5	< 5
Bicarbonate	mg CaCO3/L	< 5	< 5	< 5
Carbonate	mg CaCO3/L	< 5	< 5	< 5
Hydroxide	mg CaCO3/L	< 5	< 5	< 5
Acetic Acid*	mg/L	5	< 1	15
Butyric Acid*	mg/L	< 2	< 2	< 2
Caproic Acid*	mg/L	< 5	< 5	< 5
Formic Acid*	mg/L	2	< 1	< 1
Heptanoic Acid*	mg/L	< 5	< 5	< 5
Isobutyric Acid*	mg/L	< 2	< 2	< 2
Isocaproic Acid*	mg/L	< 5	< 5	< 5
Isovaleric Acid*	mg/L	< 2	< 2	< 2
Propionic Acid*	mg/L	< 2	< 2	< 2
Total VFA (as acetic acid)	mg/L	< 18	< 18	< 18
Valeric Acid*	mg/L	< 5	< 5	< 5

Parameter	Units	RT Pastoral Lease	
		23/02/2022	15/06/2022
Volume	mL	3000	>15,000
Ammonia-N	mg/L	0.16	0.05
Calcium (filtered)	mg/L	0.7	< 0.1
Chloride	mg/L	7.1	< 5
Filterable Reactive Phosphorus	mg/L	< 0.01	< 0.01
Magnesium (filtered)	mg/L	0.4	< 0.1
Nitrate-N	mg/L	0.23	0.03
Nitrite-N	mg/L	0.02	< 0.01
NOx-N	mg/L	0.24	0.03
pH	pH units	8.6	5.6
Potassium (filtered)	mg/L	0.6	0.2
Sodium (filtered)	mg/L	4.4	0.6
Sulfate	mg/L	1.1	< 1
Total Kjeldahl Nitrogen	mg/L	0.5	2.1
Total Nitrogen	mg/L	0.7	2.1
Alkalinity	mg CaCO3/L	11	< 5
Bicarbonate	mg CaCO3/L	7.4	< 5
Carbonate	mg CaCO3/L	< 5	< 5
Hydroxide	mg CaCO3/L	< 5	< 5
Acetic Acid*	mg/L	6	18
Butyric Acid*	mg/L	< 2	< 2
Caproic Acid*	mg/L	< 5	< 5
Formic Acid*	mg/L	2	< 1
Heptanoic Acid*	mg/L	< 5	< 5
Isobutyric Acid*	mg/L	< 2	< 2
Isocaproic Acid*	mg/L	< 5	< 5
Isovaleric Acid*	mg/L	< 2	< 2
Propionic Acid*	mg/L	< 2	< 2
Total VFA (as acetic acid)	mg/L	< 18	18
Valeric Acid*	mg/L	< 5	< 5

Parameter	Units	AAQ Station	AAQ Station duplicate	AAQ Station	AAQ Station duplicate	AAQ Station	AAQ Station duplicate
		11/02/2022	11/02/2022	19/05/2022	19/05/2022	15/06/2022	15/06/2022
Volume	mL	1800	1800	8000-9000	8000-9000	8000	8000
Ammonia-N	mg/L	0.38	0.37	0.04	0.06	0.06	0.07
Calcium (filtered)	mg/L	0.4	0.4	< 0.1	< 0.1	< 0.1	0.1
Chloride	mg/L	< 5	< 5	< 5	< 5	< 5	< 5
Filterable Reactive Phosphorus	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Magnesium (filtered)	mg/L	0.2	0.2	0.1	0.1	0.1	< 0.1
Nitrate-N	mg/L	0.22	< 0.01	< 0.01	0.02	< 0.01	< 0.01
Nitrite-N	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
NOx-N	mg/L	0.22	0.23	< 0.01	0.02	< 0.01	< 0.01
pH	pH units	5.7	5.7	5.4	5.3	5.4	5.5
Potassium (filtered)	mg/L	0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Sodium (filtered)	mg/L	1.3	1.3	0.6	0.6	0.9	0.9
Sulfate	mg/L	< 1	1	< 1	< 1	< 1	< 1
Total Kjeldahl Nitrogen	mg/L	0.9	0.8	< 0.2	< 0.2	0.2	0.2
Total Nitrogen	mg/L	1.1	1	< 0.2	< 0.2	0.2	0.2
Alkalinity	mg CaCO3/L	< 5	< 5	< 5	< 5	< 5	< 5
Bicarbonate	mg CaCO3/L	< 5	< 5	< 5	< 5	< 5	< 5
Carbonate	mg CaCO3/L	< 5	< 5	< 5	< 5	< 5	< 5
Hydroxide	mg CaCO3/L	< 5	< 5	< 5	< 5	< 5	< 5
Acetic Acid*	mg/L	6	4	< 1	< 1	14	12
Butyric Acid*	mg/L	< 2	< 2	< 2	< 2	< 2	< 2
Caproic Acid*	mg/L	< 5	< 5	< 5	< 5	< 5	< 5
Formic Acid*	mg/L	2	3	< 1	< 1	< 1	< 1
Heptanoic Acid*	mg/L	< 5	< 5	< 5	< 5	< 5	< 5
Isobutyric Acid*	mg/L	< 2	< 2	< 2	< 2	< 2	< 2
Isocaproic Acid*	mg/L	< 5	< 5	< 5	< 5	< 5	< 5
Isovaleric Acid*	mg/L	< 2	< 2	< 2	< 2	< 2	< 2
Propionic Acid*	mg/L	< 2	< 2	< 2	< 2	< 2	< 2
Total VFA (as acetic acid)	mg/L	< 18	< 18	< 18	< 18	< 18	< 18
Valeric Acid*	mg/L	< 5	< 5	< 5	< 5	< 5	< 5

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